CHAPTER 3

IDENTIFICATION OF TARGET DISTRIBUTION FACILITIES

CHAPTER 3 IDENTIFICATION OF TARGET DISTRIBUTION FACILITIES

3.1 General

The Master Plan in this Study is formulated for implementing the rehabilitation and reconstruction of distribution facilities in the Study area over ten years. The Master Plan should ensure a stable and reliable power supply to customer will be realized for to customer for some additional years, after the Master Plan is completed.

Although the Study area was relatively small in size of around 130 km^2, the amount of distribution facilities constituting the network is extensive. In this respect, it is important to set the clear-cut criteria to identify the facilities to be rehabilitated among such a number of facilities within a limited course of time. For the criteria and approach considered, and selection results, the explanation for each item is given below.

It is noted that among the identified facilities to be rehabilitated through the criteria and approach explained below, some facilities with less urgency might be included, and those with more urgency might be excluded on the other hand. This will inevitably happen when the facilities satisfying certain criteria have to be selected from a number of facilities. Such contradictions will be dealt with by the detailed design stage, when the Master Plan is actually implemented.

3.2 Medium Voltage Underground Lines

Most of the MV distribution lines in the Study area are underground lines, and overhead lines account for very little particularly in the suburban area of the Study area. In the suburban area, the demand density is generally low, and any special issues have not been pointed out by the counterpart. Furthermore, the information/data on the overhead lines has not been properly accumulated and managed. Therefore, the MV distribution line to be identified for rehabilitation has been limited to the underground line.

For the underground line to be identified, the following items have been examined. The priority order for the identified lines is in accordance with the order specified below and the laying year of the cable.

(1) The cable laid before 1960

Among the cables in each Study area, the oldest ones are shown in Table II.3.2-1. The cable in Sabail district is the oldest, which was laid in 1900. The length of cable by the laying year is also shown in Table II.3.2-2.

It is noted that the total length in Table II.3.2-2 differs from the sum of each figure (shown in Table II.2.3-1) since the cable of which the laying year is unknown is excluded. It is clear that there are a number of cables still left, which have been in use for more than 50 years. Furthermore, most of such cables are characterized with the record of ground fault and damage by fire, and consequently this part of the cable has been replaced. Therefore, the urgent rehabilitation is deemed necessary.

Table II.3.2-1 The oldest cable laying year by district

		Sabail	Yasamal	Nasimi	Narimanov	Nizami	Khatai
Laying year	6 kV system	1900	1928	1911	1926	1915	1967
	10 kV system	1931*	1950	1960*	1958*	1948*	1936

Note *: Cables for 6 kV

Table II.3.2-2 The cable length by the laying year (km)

Laying year		Sabail	Yasamal	Nasimi	Narimanov	Nizami	Khatai	Total
6 kV system	1900-10	4.51	0	0	0	0	0	4.52
	1911-20	1.07	0	3.14	0	2.36	0	6.56
	1921-30	5.29	0.96	4.67	1.72	0	0	12.64
	1931-40	6.65	2.10	3.89	1.62	0	0	14.25
	1941-50	2.79	0	3.58	3.76	0	0	10.13
	1951-60	18.60	41.22	28.68	33.00	0	0	121.50
	1961-70	10.50	31.22	30.53	14.78	0	0.54	87.57
	1971-80	16.62	12.88	9.99	18.76	0.30	3.85	62.39
	1981-90	1.83	11.74	4.31	1.30	0	0.40	19.57
	1991-00	2.40	1.14	6.67	8.18	0	0.50	20.17
Total		70.25	102.54	95.44	83.11	2.66	5.29	359.29
10 kV system	1900-10	0	0	0	0	0	0	0
	1911-20	0.26	0	0	0	0	0	0.26
	1921-30	0	0	0	0	0	0	0
	1931-40	0	0	0	0	0	1.2	1.20
	1941-50	0	1.05	0	0	0.41	0	1.46
	1951-60	0	0	0.13	3.36	4.11	1.22	8.82
	1961-70	0.34	7.47	13.60	10.05	36.92	1.00	69.39
	1971-80	20.53	36.89	26.43	19.20	23.43	63.44	189.91
	1981-90	20.24	37.96	7.78	6.04	18.87	36.03	126.63
	1991-00	7.95	20.51	1.77	4.62	14.22	15.41	64.47
Total		49.32	103.87	49.71	42.97	97.95	118.30	462.12

(2) The cable with more than two joints

The cable connections within the line deteriorates in reliability, makes it difficult to repair compared with the overhead line, and therefore should be avoided as much as possible. However, this has been inevitably practiced under the following case.

(a) Where the other drum of cable needs to be used since the one drum of cable is in short supply for laying the new cable line. In this case, the laying year of those cables is the same.

(b) Where the cable is drawn into the new transformer station by cutting existing cable, and connecting new cable. In this case, the cable joint is surely added with different laying years.

(c) Where the part of the cable laid in the line is replaced due to deteriorated insulation and damage by fire. In this case, one or two cable joints are surely added with different laying years.

Among the above cases, case (c) should be noted as most problematic. More deteriorated insulation than other cable, or the problem in the material of cable can be considered as cause of the accident. Accordingly, the lines, which have more than two joints with different laying year of each cable, are identified for rehabilitation, irrespective of their laying year. Although it is supposed that the cable with one cable joint is also required for urgent rehabilitation, such cable is excluded from the target since it is difficult to identify according to the information collected.

(3) The use of 6 kV cable in the 10 kV system

It is considered that 10 kV system has been adopted in Baku City since 1965, referring to the laying year of cable. At that time, the existing 6 kV system was diverted, but not totally replaced by 10 kV system. This practice is not technically favored, and needs to be rectified. In fact, a part of cables has been frequently replaced due to the reason mentioned in item (iii) in clause (b), after the switching to 10 kV system. In other word, it is evident that 6 kV cable used in 10 kV system shows much higher ratio of accidents than the same cable in 6 kV system. Accordingly, the 6 kV cables used in 10 kV system are to be rehabilitated irrespective of their laying year.

The underground cable lines identified by the above selection criteria is shown in Table II.3.2-3, and the details are provided in Appendixes II.3.2-1 (1) to (6). As evident in the table, underground cable lines are heavily obsolete, and 35.6 % of the total length in the whole Study area needs to be replaced.

Table II.3.2-3 Underground lines to be rehabilitated (km)

	Sabail	Yasamal	Nasimi	Narimanov	Nizami	Khatai	Total
6 kV underground line							
(a) laid before 1960	37.95	44.28	43.95	39.04	1.18	-	166.40
(b) more than 2 joints	5.49	3.68	6.90	3.29	-	-	19.36
Sub-total	43.44	47.96	50.85	42.33	1.18	-	185.76
10 kV underground line							
(a) laid before 1960	0.26	1.05	0.13	3.36	4.22	1.81	10.82
(b) more than 2 joints	2.13	5.20	4.07	3.38	3.21	4.57	22.56
(c) using 6 kV cable	-	1.58	1.62	3.23	7.36	-	13.80
Sub-total	2.39	7.83	5.82	9.97	14.78	6.38	47.18
Total	45.83	55.79	56.67	52.20	15.96	6.38	232.94
Ratio against the existing cable line length (%)	47.7	34.9	46.4	45.5	19.8	7.8	35.6

Note *1 : Corresponding lines (#1-#655) exist, but the length is unknown.

3.3 Medium Voltage Switchgears

For the part of the existing circuit breakers, the bulk-oil type breakers manufactured during the 1930's are still used. However, the rest of them are minimum-oil content type breakers. The vacuum and SF 6 gas type breakers widely used over the world are not used at all. According to BEN, when bulk-oil type breaker becomes out of order, replacement with minimum-oil content type has been done from time to time. No scheduled replacement of all the bulk-oil type has been practiced with reference to its installment year. Therefore, it is impossible to identify the switchgears to be rehabilitated in accordance with the year of installation, and the following items are examined for their identification.

(1) Switchgears in the transformer station using the bulk-oil type circuit breakers

The list of transformer station using the bulk-oil type circuit breaker provided by BEN is shown in Appendix II.3.3-1. As known from the appendix, still 89 units are used. In Sabail district where the largest number of units is left, there are 35 units used in 16 transformer stations. All of those stations using the bulk-oil type breaker are to be rehabilitated. Although the priority order is higher than the transformer stations identified through the criteria in the next section, the order is in accordance with the identification number of transformer stations since some of the manufactured year of the breaker is unknown. The transformer stations replaced with minimum-oil content type breakers and owned by customers are excluded from the list of rehabilitation target shown in Appendix II.3.3-1, by conducting the survey for each individual transformer station.

(2) Switchgears connected to the underground cables laid before 1960

Due to the limited time of the detailed survey for related transformer stations, the criteria that the transformer station, which connects to the old cable, is considered as old, is applied to identify the facilities. The MV switchgears in the transformer stations, which are connected to the underground cables laid before 1960 and constructed before 1970, are to be rehabilitated.

The replacement of minimum-oil content and bulk-oil type circuit breakers by the maintenance-free vacuum or SF6 gas type provides a meaningful effect for maintenance work, because the minimum oil content and bulk oil type require insulation oil replacement after several cut-off operation of fault current and relatively heavy maintenance. The priority order is in accordance with the laying year of underground cables connected.

The outlines for the transformer stations equipped with the MV switchgears identified for rehabilitation through the above criteria is shown in Table II.3.3-1, and its details in Appendixes II.3.3-2 (1) to (5).

Table II.3.3-1 MV switchgears (transformer stations) to be rehabilitated

	Sabail	Yasamal	Nasimi	Narimanov	Nizami	Khatai	Total
The number of T/S using bulk-oil type circuit breaker	16	12	10	2	-	-	40
The number of T/S connecting to the underground cable laid before 1960	34	67	59	52	10	-	222
Total	50	79	69	54	10	-	262
Ratio against the existing transformer stations (%)	33.6	32.0	32.1	29.7	9.0	0.0	23.8

As evident from above table, there is no transformer station, which meets those criteria in Khatai district, since electrification of Khatai district was later than other districts.

3.4 Transformers

Total 328 units of transformer were brought into repair shop during 1998. The number and ratio of transformers brought into the repair shop by nature of damage are shown in Table II.3.4-1. In the item "inefficient insulation", those which needed repairing the part of the coil without replacing the whole coil are included. As observed from the table, there have been many accidents requiring considerably large repairs, and the reason progress of overage as well as the impact of overload is supposed.

Table II.3.4-1 Transformer repair record in 1998

	No. of units	Ratio (%)
Abolition	28	8.5
Inefficient insulation	124	37.8
Accident by short	27	8.2
Burned by overload (total repairing)	21	6.4
Others	78	23.8
No-repairing	50	15.2
Total	328	100

However, as the track record of repairing and accident for each transformer has not been maintained, reliable information has not been available and therefore it is difficult to identify the transformer for rehabilitation. Furthermore, as neither the record for manufactured and purchased year of each transformer is stocked, the identification according to the used year is hardly possible. Under this situation, the transformers to be rehabilitated are identified as those equipped in the transformer stations using the switchgears selected in Section 3.3. It is noted, however, that the number of transformers identified here have not been derived by identifying the unit with technical problem. The number only indicates the number of units to be rehabilitated. Resultantly, the number of units to be rehabilitated is derived and shown in Table II.3.4-2. Total capacity of transformers will be decided taking account of the value of demand forecast in 2010 prepared by this Study. For transformers with smaller capacity than 400 kVA, the capacity for their procurement will be calculated based on 400 kVA.

The summary of transformers identified for rehabilitation is shown in Table II.3.4-2. The detailed information by each district in the Study area is also provided in Appendix II.3.4-1.

Table II.3.4-2 Transformers to be rehabilitated

Item	Number of units	Capacity (kVA)
20 - 400 kVA	217	74,855
560 - 630 kVA	151	93,450
750 - 1000 kVA	6	5,750
Total	374	174,055

3.5 Low Voltage Circuits

For both LV switchgears and lines constituting the LV circuit, as in the case of transformers, only LV circuit for the transformer stations using MV switchgears to be rehabilitated is targeted for cost estimation purpose. The items to be rehabilitated include the low voltage distribution panels in the transformer station, the low voltage feeders from the panel to customer, and the watt-hour meter installed for the customer. The amount of those facilities will be estimated based on the average laying number to be estimated by the Study Team.

Appendix II.3.2-1(1) 6kV & 10kV Underground Cables to be replaced under the M/P in Sabail

No.	From Network No.	From Station No.	To Network No.	To Station No.	Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
(before 1960)														
1	1	1	1	628	1	6.0	2	СБ-6	3 x 95	486	486	1900	I	ACB6,3x150:50(73);CB10,3x150(75)
2	1	628	1	667	1	6.0	2	СБ-6	3 x 95	410	410	1900	I	ACB10,3x150:50(73),230(83)
3	1	667	88	1903	1	6.0	1	СБ-6	3 x 95	517	517	1900	I	ACB10,3x150:230(83)
4	1	1	88	1903	1	6.0	1	СБ-6	3 x 95	880	880	1910	I	CB10,3x150:148(75)
5	1	2	2	129	1	6.0	2	СБ-6	3 x 70	480	480	1910	I	СБ-63x95:25(10),СБ-63x95:430(10),
6	2	20	2	23	1	6.0		СБ-6	3 x 95	377	377	1910	I	
7	2	129	88	119	1	6.0	1	СБ-6	3 x 95	1,365	1,365	1910	I	АСБ-6 3x185:520(59)
8	1	10	1	13	1	6.0	1	СБ-6	3 x 70	371	371	1912	I	ACB6,3x95:40(--)
9	1	10	1	32	1	6.0	1	СБ-6	3 x 70	364	364	1912	I	ACB6,3x95:40(--)
10	3	25	2	34	1	6.0	1	СБ-6	3 x 50	330	330	1913	I	ACB10,3x150:170(83)
11	2	23	2	129	1	6.0		СБ-6	3 x 95	1,203	1,203	1926	I	
12	1	1	1	2	2	6.0	1	СБ-6	3 x 95	760	1,520	1928	I	СБ-10,3x150:140m(19--)
13	1	1	1	354	1	6.0	2	СБ-6	3 x 95	392	392	1928	I	ACB-6,3x150:120m(61);92m(75)
14	1	354	88	1903	1	6.0	1	СБ-6	3 x 95	644	644	1928	I	ACB10,3x150:120(61)
15	2	12	3	16	1	6.0	1	СБ-6	3 x 50	370	370	1929	I	AAB10,3x185:0(88)
16	2	12	2	966	1	6.0		СВ-6	3x50	421	421	1929	I	
17	2	23	2	33	1	6.0		СБ-6	3 x 95	345	345	1929	I	
18	3	25	3	966	1	6.0	3	СБ-6	3 x 70	20	20	1929	I	АСБ-10 3x150:50(83),СБ-6 3x50:263(29),ААБ-10 3x185:0(89)
19	2	33	2	348	1	6.0		СБ-6	3 x 95	120	120	1929	I	
20	2	20	2	53	1	6.0		СБ-6	3 x 70	252	252	1930	I	
21	5	60	5	98	1	6.0		СБ-6	3 x 95	260	260	1931	I	
22	5	60	5	98	1	10.0		СБ-6	3 x 95	260	260	1931	I	
23	2	17	2	519	1	6.0	1	СБ-6	3 x 95	1,322	1,322	1932	II	АСБ-10 3 x 185:100(80)
24	2	17	88	119	1	6.0	3	СБ-6	3 x 95	1,455	1,455	1932	II	СБ-6 3x95:100(32),АСБ-6 3x150:825(59),АСБ-10 3x150:400(79)
25	2	23	2	519	1	6.0	1	СБ-6	3 x 95	200	200	1932	II	СБ-10 3x150:100(80)
26	2	5	2	7	1	6.0		СБ-6	3 x 70	427	427	1933	II	
27	2	5	2	129	1	6.0	2	СБ-6	3 x 70	614	614	1933	II	СБ-6 3 x 70:220(60),АСБ-63 x 185:325(60)
28	2	6	2	7	1	6.0		СБ-6	3 x 70	272	272	1933	II	
29	2	7	2	330	1	6.0	1	СБ-6	3 x 70	250	250	1933	II	СБ-6 3x185:70(60)
30	2	22	2	330	1	6.0	1	СБ-6	3 x 70	387	387	1933	II	СБ-6 3x185:70(33)
31	2	22	2	23	1	6.0		СБ-6	3 x 150	282	282	1933	II	
32	3	25	3	468	1	6.0	2	АСБ-10	3 x 95	298	298	1933	II	ACB10,3x1855:35(75);3x150:50(83)
33	2	23	2	162	1	6.0	1	СБ-6	3 x 95	285	285	1936	II	АСБ-10 3x185:25(80)
34	2	5	2	200	1	6.0		СБ-6	3 x 70	367	367	1940	II	
35	2	5	2	201	1	6.0		СБ-6	3 x 70	230	230	1940	II	
36	5	57	5	411	1	6.0	1	СБ-6	3 x 95	795	795	1948	II	СБ-6 3 x 185:350(49)
37	5	57	5	98	1	6.0		СБ-6	3 x 95	394	394	1948	II	
38	5	49	5	77	1	6.0		СБ-6	3 x 95	340	340	1949	II	
39	5	49	5	411	1	6.0		СБ-6	3 x 95	260	260	1949	II	
40	5	77	5	326	1	6.0	2	СБ-6	3 x 95	290	290	1949	II	СБ-6 3 x 70:150(49),АСБ-6 3 x 150:320(60)
41	5	77	5	411	1	6.0		СБ-6	3 x 95	150	150	1949	II	
42	1	13	1	628	1	6.0	2	СБ-6	3 x 70	115	115	1950	II	ACB10,3x150:50(73),15(91)
43	1	628	88	1903	1	6.0	1	СБ-6	3 x 70	450	450	1950	II	ACB10,3x150:50(73)
44	2	8	2	329	1	6.0	2	СБ-6	3 x 70	855	855	1952	III	АСБ-6 3x185:115(61),ААБЛ-10 3x95:350(80)
45	2	291	2	743	1	6.0	3	СБ-6	3 x 185	173	173	1952	III	АСБ-6 3x185:21(61),АСБ-10 3x185:7(78),АСБ-10 3x70:145(58)
46	2	573	2	743	1	6.0	2	СБ-6	3 x 185	567	567	1952	III	СБ-10 3 x 150:180(73),АСБ-10 3 x 185:7(78)
47	2	6	2	462	1	6.0	1	СБ-6	3 x 70	65	65	1954	III	АСБ-6 3x185:30(64)
48	2	11	2	462	1	6.0	2	СБ-6	3 x 95	558	558	1954	III	АСБ-6 3x185:30(64),СБ-6 3x70:45(54)
49	2	11	2	573	1	6.0	2	СБ-6	3 x 95	329	329	1954	III	СБ-10 3x150:125(73),СБ-6 3x70:21(54)
50	2	4	2	7	1	6.0	1	АСБ-6	3 x 95	483	483	1957	IV	АСБ-6 3x185:113(60)
51	2	4	2	107	1	6.0	1	АСБ-6	3 x 95	220	220	1957	IV	АСБ-6 3x185:110(60)
52	2	9	2	301	1	6.0		АСБ-6	3 x 120	210	210	1957	IV	
53	1	103	1	453	1	6.0	2	СБ-6	3 x 95	415	415	1958	V	ACB6,3X150(175),3X185(200)
54	2	8	2	573	1	6.0	1	СБ-6	3 x 185	340	340	1958	V	СБ-6 3x150:180(74)
55	1	103	1	550	1	6.0	1	АСБ-6	3 x 150	385	385	1958	V	AAB10,3X185:190(70)
56	1	105	1	550	1	6.0	1	АСБ-6	3 x 150	350	350	1958	V	ACB10,3X185(190)
57	2	108	2	109	1	6.0		АСБ-6	3 x 95	245	245	1958	V	
58	2	200	2	291	1	6.0	1	АСБ-6	3 x 70	145	145	1958	V	АСБ-6 3x185:21(61)
59	1	2	88	119	2	6.0	2	АСБ-6	3 x 185	205	410	1959	VI	ACB6,3x120:200(59);ACB6,3x120:210(59)
60	2	5	2	11	1	6.0		АСБ-6	3 x 120	550	550	1959	VI	
61	1	102	1	476	1	6.0	1	СБ-6	3 x 95	315	315	1959	VI	ACB6,3X185:80(65)
62	1	105	1	247	1	6.0		АСБ-6	3 x 120	300	300	1959	VI	
63	2	107	2	109	1	6.0		АСБ-6	3 x 95	300	300	1959	VI	
64	5	179	2	321	1	6.0	1	СБ-6	3 x 185	645	645	1959	VI	СБ-6 3x95:210(60)

Appendix II.3.2-1(1) 6kV & 10kV Underground Cables to be replaced under the M/P in Sabail

No.	From Network No.	From Station No.	To Network No.	To Station No.	Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
65	1	247	88	119	1	6.0		АСБ-6	3 x 120	235	235	1959	VI	
66	5	320	5	500	1	6.0	2	АСБ-6	3 x 185	728	728	1959	VI	ААШБ-10 3 x 150:115(73),АСБ-10 3 x 185:33(67)
67	5	320	88	220	1	6.0	1	АСБ-6	3 x 185	1,590	1,590	1959	VI	СБ-6 3x95:940(0)
68	1	322	1	476	1	6.0	1	СБ-6	3 x 95	135	135	1959	VI	АСВ10,3X185:80(65)
69	1	2	2	17	1	6.0	2	АСБ-6	3 x 185	1,364	1,364	1959	VI	АСБ-10 3x150:500(73),АСБ-10 3x185:814(76)
70	1	13	1	667	1	6.0	2	СБ-6	3 x 70	305	305	1959	VI	АСВ10,3x185:140(75),СВ10,3x185:15(91)
71	2	23	88	119	1	6.0	3	СБ-6	3 x 185	2,466	2,466	1959	VI	АСБ-10 3x185:470(71),СБ-6 0:586(0),АСБ-10 3x150:270(71)
72	2	41	2	321	1	6.0	2	СБ-6	3 x 50	230	230	1959	VI	СБ-6 3 x 185:435(59),СБ-6 3x50:70(59)
73	2	4	2	108	1	6.0	1	СБ-6	3 x 70	1,269	1,269	1960	VII	СБ-6 3x50:219(60)
74	2	17	2	23	1	6.0		АСБ-6	3 x 120	1,275	1,275	1960	VII	
75	1	101	1	102	1	6.0		АСБ-6	3 x 120	195	195	1960	VII	
76	1	101	1	453	1	6.0		АСБ-6	3 x 120	530	530	1960	VII	
77	5	179	4	527	1	6.0	1	СБ-6	3 x 50	422	422	1960	VII	СБ-6 3x95:342(60)
Subtotal of before 1960					79					38,209	39,174			
(with 2 or more joints cable)														
78	5	147	5	326	1	6.0	3	ААБ-6	3 x 120	1,085	1,085	1962	VIII	СБ-6 3x95:[illegible](70),ААБ-10 3x120:120(71),ААБ-10 3x120:245(71)
79	2	66	5	147	1	6.0	2	АСБ-6	3 x 185	890	890	1962	VIII	ААБ-10 3x185:110(91),ААБ-10 3x185:130(72)
80	2	12	2	573	1	6.0	3	АСБ-10	3 x 150	432	432	1973	IX	СБ-6 3x70:307(0),ААБ-10 3x185:0(0),0 0:0(0)
81	2	162	2	519	1	6.0	3	АСБ-10	3 x 150	780	780	1973	IX	ААБ-10 3x185:200(80),СБ-6 3x70:240([illegible]),АСБ-6 3x185:410([illegible])
82	2	301	2	348	1	6.0	2	СБ-6	3 x 50	300	300	1976	IX	АСБ-10 3x185:73(84),СБ-6 3x185:45(76)
83	2	348	5	450	1	6.0	2	АСБ-10	3 x 150	2,000	2,000	1980	X	СБ-6 3x185:1460(89),АСБ-10 3x185:120(89)
84	1	600	88	1907	4	10.0	2	ЦААШБ-10	3 x 185	2,125	8,500	1980	X	АСБ-10 3x185:730(80),ЦАСБ-10 3x185:150(80)
Subtotal of with 2 or more joints cable					10					7,612	13,987			
Total					89					45,821	53,161			

Appendix II.3.2-1(2) 6kV & 10kV Underground Cables to be replaced under the M/P in Yasamal

No.	From Network No.	From Station No.	To Network No.	To Station No.	Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
(before 1960)														
1	2	26	3	50	1	6.0	1	СБ-6	3 x 50	324	324	1928	I	СБ-6 3 x 95:60(28)
2	2	26	2	348	1	6.0		СБ-6	3 x 95	184	184	1928	I	
3	2	26	3	28	1	6.0	1	СБ-6	3 x 70	215	215	1929	I	АСБ-6 3 x 150:65(62)
4	3	28	3	35	1	6.0	2	СБ-6	3 x 70	235	235	1929	I	АСВ6,3x150:65(62);АСВ10,3x185:70(74)
5	3	19	3	27	1	6.0		АСБ-6	3 x 70	300	300	1933	II	
6	3	19	3	468	1	6.0	1	АСБ-6	3 x 70	165	165	1933	II	АСВ10,3x185:35(75)
7	3	18	3	19	1	6.0		СБ-6	3 x 50	304	304	1935	II	
8	4	29	4	222	1	6.0	1	СБ-6	3 x 70	375	375	1935	II	АС6,3x150:242(59)
9	3	35	3	48	1	6.0		СБ-6	3 x 50	395	395	1935	II	
10	3	18	3	85	1	6.0		СБ-6	3 x 70	292	292	1936	II	
11	2	26	3	85	1	6.0		СБ-6	3 x 70	150	150	1936	II	
12	4	83	4	378	1	6.0	1	СБ-6	3 x 70	120	120	1936	II	АС10,3x185:30(65)
13	17	748	4	911	1	10.0	2	АСБ-10	3 x 120	1,045	1,045	1950	II	АСБ-10 3x150:940(75,98)
14	3	27	3	38	1	6.0		СБ-6	3 x 95	462	462	1951	III	
15	3	38	3	516	1	6.0		СБ-6	3 x 95	600	600	1951	III	
16	3	38	88	120	1	6.0		СБ-6	3 x 95	1,313	1,313	1951	III	
17	4	99	3	603	1	6.0	2	СБ-6	3 x 95	516	516	1952	III	ААШБ-10 3x240:80(71),СБ-10 3x95:12(71)
18	4	104	88	120	1	6.0		СБ-6	3 x 70	480	480	1952	III	
19	4	123	4	235	1	6.0	1	СБ-6	3 x 50	270	270	1952	III	С6,3x70:200(68)
20	4	235	88	120	1	6.0	1	СБ-6	3 x 50	470	470	1952	III	СБ-6 3x70:200(68)
21	4	39	88	111	1	6.0	1	СБ-6	3 x 95	590	590	1953	III	АСБ-10 3x240:370(98)
22	4	104	4	383	1	6.0	1	СБ-6	3 x 95	370	370	1953	III	С6,3x70:190(58)
23	4	142	4	529	1	6.0		СБ-6	3 x 95	770	770	1953	III	
24	3	14	3	16	1	6.0	3	СБ-6	3 x 95	544	544	1954	III	СВ6,3x95:85(54),254(58);АСВ10,3x150:102(73)
25	4	30	4	206	1	6.0	2	СБ-6	3 x 120	485	485	1954	III	С6,3x185:145(54);АС10,3x150:20(68)
26	4	39	4	206	1	6.0		СБ-6	3 x 185	300	300	1954	III	
27	3	131	88	120	1	6.0		СБ-6	3 x 50	1,700	1,700	1954	III	
28	4	132	4	296	1	6.0		СБ-6	3 x 95	440	440	1954	III	
29	4	132	4	423	1	6.0		СБ-6	3 x 95	140	140	1954	III	
30	4	134	4	472	1	6.0	1	СБ-6	3 x 95	546	546	1954	III	С6,3x150:75(64)
31	4	137	4	423	1	6.0	1	СБ-6	3 x 95	272	272	1954	III	АС6,3x185:12(63)
32	4	142	4	751	1	6.0	2	СБ-6	3 x 50	950	950	1954	III	С6,3x95:850(54);АС10,3x150:75(80)
33	3	27	3	551	1	6.0	1	СБ-6	3 x 95	445	445	1955	IV	АСБ-10 3x150:135(69)
34	4	123	4	342	1	6.0	3	АСБ-6	3 x 185	806	806	1955	IV	АС6,3x95:171(60);АС6,3x150:250(68);АА6,3x240:75(68)
35	3	124	3	273	1	6.0	2	СБ-6	3 x 70	558	558	1955	IV	С6,3x95:241(58);3x185:141(62)
36	4	144	88	111	1	6.0	1	СБ-6	3 x 95	270	270	1955	IV	С6,3x150:150(66)
37	3	273	5	289	1	6.0	1	СБ-6	3 x 70	134	134	1955	IV	С6,3x95:361(58)
38	4	277	9	233	1	6.0	4	СБ-6	3 x 95	1,327	1,327	1955	IV	[illegible]
39	4	288	4	385	1	6.0		АСБ-6	3 x 185	320	320	1955	IV	
40	4	288	4	641	1	6.0	2	АСБ-6	3 x 185	375	375	1955	IV	АС10,3x185:120(65);АС10,3x150:60(73)
41	5	289	3	516	1	6.0	3	СБ-6	3 x 70	1,040	1,040	1955	IV	С6,3x95:100(58);3x70:12(60);АС10,3x185:195(71)
42	4	207	4	751	1	6.0	1	СБ-6	3 x 95	385	385	1956	IV	АС10,3x50:75(80)
43	6	37	4	134	1	6.0	1	АСБ-6	3 x 185	903	903	1957	IV	АС10,3x150:470(74)
44	3	85	2	301	1	6.0		АСБ-6	3 x 185	360	360	1957	IV	
45	3	90	3	272	1	6.0		СБ-6	3 x 95	525	525	1957	V	
46	4	114	4	216	1	6.0		СБ-6	3 x 95	150	150	1957	V	
47	3	118	3	131	1	6.0		СБ-6	3 x 70	370	370	1957	V	
48	3	121	3	961	1	6.0	1	АСБ-10	3 x 120	305	305	1957	V	АСБ-10 3 x 120:5(95)
49	3	124	3	391	1	6.0	1	СБ-6	3 x 95	670	670	1957	V	АС6,3x185:170(63)
50	4	174	4	207	1	6.0		СБ-6	3 x 70	420	420	1957	V	
51	4	174	4	506	1	6.0	2	АСБ-6	3 x 95	430	430	1957	V	АС6,3x185:163(62);АС10,3x150:150(69)
52	3	208	3	394	1	6.0		СБ-6	3 x 150	350	350	1957	V	
53	4	222	4	783	1	6.0	1	СБ-6	3 x 95	230	230	1957	V	АС10,3x95:150(83)
54	3	14	3	121	1	6.0	1	С-6	3x70	281	281	1958	V	СВ6,3x95:51(58)
55	4	29	4	135	1	6.0		СБ-6	3 x 50	315	315	1958	V	
56	4	30	4	914	1	6.0	2	АСБ-10	3 x 150	470	470	1958	V	ААБ-10,3x95:50(95),АСБ-10,3x150:20(68)
57	3	90	3	477	1	6.0	1	СБ-6	3 x 150	450	450	1958	V	ААВ10,3x150:0(65)
58	4	92	4	99	1	6.0	1	АСБ-6	3 x 185	400	400	1958	V	ААШ10,3x240:80(71)
59	3	118	3	299	1	6.0		СБ-6	3 x 150	230	230	1958	V	
60	3	124	3	208	1	6.0		АСБ-6	3 x 185	570	570	1958	V	
61	3	131	3	293	1	6.0	1	СБ-6	3 x 95	125	125	1958	V	АС6,3x185:35(62)
62	4	135	4	137	1	6.0		СБ-6	3 x 50	375	375	1958	V	
63	4	216	4	383	1	6.0	1	СБ-6	3 x 70	115	115	1958	V	АС6,3x185:75(62)
64	4	222	4	463	1	6.0	1	СБ-6	3 x 95	410	410	1958	V	АС10,3x150:100(68)

Appendix II.3.2-1(2) 6kV & 10kV Underground Cables to be replaced under the M/P in Yasamal

No.	From Network No.	From Station No.	To Network No.	To Station No.	Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
65	4	259	4	398	1	6.0	1	АСБ-6	3 x 185	205	205	1958	V	АС6,3x185:75(62)
66	3	272	3	297	1	6.0		АСБ-6	3 x 150	296	296	1958	V	
67	4	277	4	347	1	6.0	1	АСБ-6	3 x 185	255	255	1958	V	АА10,3x185:75(70)
68	5	289	3	290	1	6.0		СБ-6	3 x 95	360	360	1958	V	
69	3	290	3	457	1	6.0	1	СБ-6	3 x 95	134	134	1958	V	АС6,3x150:46(64)
70	3	293	3	457	1	6.0	2	СБ-6	3 x 95	217	217	1958	V	Ас6,3x150:46(64);3x185:35(62)
71	3	299	3	477	1	6.0	1	СБ-6	3 x 150	565	565	1958	V	АА10,3x150:290(65)
72	4	347	4	508	1	6.0	1	АСБ-6	3 x 185	95	95	1958	V	АА10,3x150:430(66)
73	3	35	4	292	1	6.0		АСВ-6	3x120	210	210	1959	VI	
74	4	83	4	292	1	6.0		АСБ-6	3 x 185	285	285	1959	VI	
75	4	92	4	298	1	6.0	1	АСБ-6	3 x 150	107	107	1959	VI	АС6,3x185:70(58)
76	4	134	4	296	1	6.0	1	СБ-6	3 x 95	294	294	1959	VI	С6,3x185:120(54)
77	4	136	4	137	1	6.0	1	СБ-6	3 x 95	323	323	1959	VI	С6,3x185:45(52)
78	4	137	4	172	1	6.0	1	СБ-6	3 x 70	230	230	1959	VI	С6,3x185:50(52)
79	4	174	4	238	1	6.0		АСБ-6	3 x 185	240	240	1959	VI	
80	4	207	4	460	1	6.0	1	СБ-6	3 x 95	390	390	1959	VI	АС6,3x150:90(64)
81	4	235	4	238	1	6.0		АСБ-6	3 x 150	480	480	1959	VI	
82	2	361	88	119	1	6.0	1	СБ-6	3 x 50	800	800	1959	VI	СБ-6 3x50:110(59)
83	4	460	88	120	1	6.0	1	СБ-6	3 x 95	214	214	1959	VI	АС6,3x150:90(64)
84	3	28	3	85	1	6.0		АСБ-6	3 x 150	460	460	1960	VII	
85	3	28	3	260	1	6.0	1	АСБ-6	3 x 150	170	170	1960	VII	АСВ6,3x185(60)
86	3	28	3	327	1	6.0		АСБ-6	3 x 185	392	392	1960	VII	
87	4	114	4	139	1	6.0		АСБ-6	3 x 185	350	350	1960	VII	
88	9	130	17	417	1	6.0		АСБ-6	3 x 95	90	90	1960	VII	
89	4	139	88	120	1	6.0	1	АСБ-6	3 x 185	575	575	1960	VII	АА6,3x185:320(64)
90	3	208	3	340	1	6.0		АСБ-6	3 x 185	250	250	1960	VII	
91	3	208	3	394	1	6.0		АСБ-6	3 x 185	370	370	1960	VII	
92	4	238	4	338	1	6.0		АСБ-6	3 x 185	367	367	1960	VII	
93	3	260	3	327	1	6.0		АСБ-6	3 x 185	263	263	1960	VII	
94	4	288	4	438	1	6.0	2	СБ-6	3 x 95	470	470	1960	VII	АС6,3x185:340(63);АС6,3x95:80(64)
95	4	288	4	549	1	6.0	2	СБ-6	3 x 95	610	610	1960	VII	АС10,3x150:135(74)&85(76)
96	4	298	88	120	1	6.0	2	АСБ-6	3 x 185	720	720	1960	VII	АС6,3x185:320(64);АА10,3x185:330(89)
97	4	314	4	549	1	6.0	1	СБ-6	3 x 95	285	285	1960	VII	АС10,3x150:135(60)
98	4	314	88	120	1	6.0	1	СБ-6	3 x 95	1,302	1,302	1960	VII	С6,3x95:385(60)
99	4	324	88	111	1	6.0	1	АСБ-6	3 x 185	566	566	1960	VII	С6,3x185:286(60)
100	3	327	3	498	1	6.0	1	АСБ-6	3 x 185	240	240	1960	VII	АА10,3x150:130(65)
101	17	341	9	417	1	6.0	3	АСБ-6	3 x 95	1,390	1,390	1960	VII	АС6,3x185:15(68);АС10,3x185:15(72);450(75)
102	4	342	4	385	1	6.0	1	АСБ-6	3 x 95	385	385	1960	VII	АС6,3x185:214(60)
103	3	351	3	394	1	6.0	2	АСБ-6	3 x 185	935	935	1960	VII	АС6,3x185:100(62);АА10,3x185:225(68)
Subtotal of before 1960					103					45,326	45,326			
(with 2 or more joints cable)														
104	17	568	17	629	1	6.0	2	АСБ-6	3 x 185	928	928	1961	VIII	ААБ-10 3x150.600(69),АСБ-10 3x150:(73)
105	3	118	2	413	1	6.0	3	АСБ-6	3 x 70	250	250	1962	VIII	АА10,3x185:100(83):ААШ6,3x150:140(83)
106	3	297	2	413	1	6.0	2	АСБ-6	3 x 70	1,450	1,450	1962	VIII	ААШ10,3x185:1100(75);АА10,3x185:100(83)
107	9	130	9	418	1	6.0	2	АСБ-6	3 x 185	654	654	1963	VIII	АШ10,3x150:30(70);АС10,3x185:220(--)
108	4	472	4	707	1	6.0	2	СБ-6	3 x 95	400	400	1964	IX	С6,3x150:75(64);АС10,3x185:45(77)
109	17	353	17	447	1	10.0	2	АСБ-6	3 x 185	1,234	1,234	1964	IX	ААШБ-10 3 x 185:557(78),ААШБ-10 3x150:557(78)
110	17	266	17	687	1	10.0	3	АСБ-6	3 x 120	830	830	1965	IX	АСБ-6,3x120,160(69),3x120:300(63),АСБ-10,3x120:80(91)
111	17	352	17	700	1	10.0	4	АСБ-6	3 x 185	340	340	1966	IX	[illegible]
112	17	373	17	700	1	10.0	2	АСБ-6	3 x 185	655	655	1966	IX	АСБ-10 3x185:15(68),СБ-10 3x95:280(68)
113	17	700	88	1910	2	10.0	2	ААШБ-10	3 x 185	1,470	2,940	1974	IX	АСБ-10 3x185:90(75),АСБ-10 3x185:15(77)
114	3	409	3	625	1	10.0	2	АСБ-10	3 x 150	670	670	1975	IX	АСБ-10 3x150:50(75),АСБ-10 3x150:70(80)
Subtotal of with 2 or more joints cable					12					8,881	10,351			
(use 6kV cable)														
115	17	300	17	337	1	10.0		АСБ-6	3 x 185	300	300	1963	X	
116	17	428	17	439	1	10.0		СБ-6	3 x 95	250	250	1963	X	
117	17	266	17	373	1	10.0		АСБ-6	3 x 120	270	270	1961	X	
118	17	300	17	352	1	10.0		АСБ-6	3 x 185	300	300	1961	X	
119	17	469	17	687	1	10.0	1	АСБ-6	3 x 120	230	230	1965	X	АСБ-10 3x120:80(91)
120	7	377	7	451	1	10.0		АСБ-6	3 x 95	150	150	1965	X	
121	17	352	17	524	1	10.0		АСБ-6	3 x 120	234	234	1967	X	
Subtotal of use 6kV cable					7					1,734	1,734			
Total					122					55,941	57,411			

Appendix II.3.2-1(3) 6kV & 10kV Underground Cables to be replaced under the M/P in Nasimi

No.	From Network No.	From Station No.	To Network No.	To Station No.	Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
(before 1960)														
1	2	44	5	45	1	6.0		СБ-6	3 x 95	365	365	1911	I	
2	5	78	5	234	1	6.0	1	СБ-6	3 x 70	267	267	1911	I	СБ-6 3x70:360(31)
3	5	45	5	81	1	6.0	1	СБ-6	3 x 70	358	358	1912	I	СБ-6 3x95:125(58)
4	5	46	5	81	1	6.0	1	СБ-6	3 x 70	429	429	1912	I	СБ-6 3x95:125(58)
5	5	78	5	614	1	6.0		АСБ-10	3 x 150	170	170	1912	I	
6	5	46	5	214	1	6.0	2	СБ-6	3 x 95	587	587	1913	I	СБ-6 3x70:153(72),ААБ-10 3x150:15(72)
7	8	39	88	1915	2	6.0	1	АСБ-10	3 x 240	1,180	2,360	1915	I	СБ-6 3x95:220(54)
8	5	71	5	3289	1	6.0	2	СБ-6	3 x 70	961	961	1920	I	СБ-6 3x185:430(67),СБ-10 3x95:185(70)
9	3	47	88	117	1	6.0	1	СБ-6	3 x 50	662	662	1922	I	АСБ-6 3x150:340(22)
10	3	48	88	117	1	6.0	1	АСБ-10	3 x 150	450	450	1922	I	СБ-6 3x50:100(22)
11	5	64	5	75	1	6.0	1	СБ-10	3 x 95	599	599	1923	I	СБ-10 3x95:250(70)
12	5	65	5	94	1	6.0	1	СБ-6	3 x 95	400	400	1923	I	АСБ-6 3x185:100(78)
13	5	65	88	220	1	6.0	1	СБ-6	3 x 95	670	670	1923	I	СБ-6 3x70:570(23)
14	5	75	5	94	1	6.0	2	СБ-6	3 x 50	405	405	1923	I	СБ-6 3x150:38(58),АСБ-6 3x185:40(73)
15	5	65	90	241	1	6.0		СБ-6	3 x 70	250	250	1926	I	
16	6	67	7	70	1	6.0	2	СБ-6	3 x 95	540	540	1926	I	С6,3x70:160(56);АА10,3x150:140(82)
17	3	15	3	58	1	6.0	1	СБ-6	3 x 50	175	175	1927	I	СВ6,3x70:61(--)
18	3	50	3	58	1	6.0	1	СБ-6	3 x 50	519	519	1928	I	СВ6,3x95:70(53)
19	5	45	3	51	1	6.0		СБ-6	3 x 70	293	293	1931	I	
20	3	50	3	51	1	6.0	1	СБ-6	3 x 50	340	340	1931	I	СВ6,3x95:115(53)
21	6	67	6	526	1	6.0		СБ-6	3 x 95	317	317	1931	I	
22	6	68	6	87	1	6.0		СБ-6	3 x 95	386	386	1931	I	
23	6	68	6	526	1	6.0		СБ-6	3 x 95	315	315	1931	I	
24	6	87	6	390	1	6.0	1	СБ-6	3 x 95	415	415	1931	II	АС6,3x150:145(63)
25	6	89	6	390	1	6.0	1	СБ-6	3 x 95	375	375	1931	II	АС6,3x150:145(63)
26	3	15	3	47	1	6.0	1	СБ-6	3 x 50	262	262	1935	II	СВ6,3x70:50(--)
27	3	48	5	106	1	6.0	1	СБ-6	3 x 70	410	410	1935	II	АСБ-10 3x185:200(77)
28	2	44	2	162	1	6.0	2	СБ-6	3 x 95	645	645	1936	II	ААБ-10 3x185:25(80),СБ-6 3x50:460(0)
29	6	87	6	838	1	6.0	1	СБ-6	3 x 70	130	130	1938	II	АС10,3x185:30(87)
30	6	67	6	623	1	6.0	1	СБ-6	3 x 50	230	230	1949	II	АС10,3x150:135(73)
31	6	68	6	363	1	6.0	2	СБ-6	3 x 50	408	408	1949	II	АС10,3x95:150(61);3x185:195(61)
32	5	326	88	220	1	6.0	1	СБ-6	3 x 95	1,420	1,420	1949	II	АСБ-6 3x150:320(62)
33	6	68	6	231	1	6.0	2	СБ-6	3 x 95	662	662	1950	II	С6,3x185:480(50);АС6,3x185:75(66)
34	6	170	6	226	1	6.0	1	СБ-6	3 x 95	387	387	1950	II	АС6,3x95:213(64)
35	6	170	6	396	1	6.0	1	СБ-6	3 x 50	470	470	1950	II	С6,3x95:220(55)
36	5	76	5	79	1	6.0		СБ-6	3 x 70	341	341	1951	III	
37	5	173	5	225	1	6.0	1	СБ-6	3 x 95	200	200	1951	III	АСБ-6 3x185:350(62)
38	6	89	5	173	1	6.0	2	СБ-6	3 x 95	570	570	1953	III	СБ-6 3x95:140(53),АСБ-6 3x150:167(59)
39	5	138	88	111	1	6.0	1	СБ-6	3 x 70	603	603	1953	III	АСБ-6 3x95:382(61)
40	6	231	6	390	1	6.0	2	СБ-6	3 x 95	280	280	1953	III	АС6,3x150:75(53);АС6,3x185:135(66)
41	5	52	5	214	1	6.0	1	СБ-6	3 x 95	490	490	1954	III	АСБ-10150:80(80)
42	6	67	5	71	1	6.0		СБ-6	3 x 95	476	476	1954	III	
43	6	86	6	150	1	6.0	2	СБ-6	3 x 70	65	65	1954	III	С6,3x95:180(54);ААШ,3x185:140(54)
44	5	155	5	831	1	6.0		СБ-6	3 x 70	545	545	1954	III	
45	5	156	5	180	1	6.0		АСБ-6	3 x 120	495	495	1954	III	
46	5	156	1	228	1	6.0	1	СБ-6	3 x 70	335	335	1954	III	АСБ-10 3x185:50(74)
47	5	228	5	831	1	6.0	1	СБ-6	3 x 70	305	305	1954	III	АСБ-6 3x185;130(77)
48	5	234	5	310	1	6.0	2	СБ-6	3 x 70	300	300	1954	III	СБ-6 3x95:400(55),СБ-6 3x185:100(59)
49	6	422	88	96	1	6.0	3	СБ-6	3 x 95	473	473	1954	III	АС6,3x150:117(62);56(63);АС10,3x185:50(78)
50	5	71	5	310	1	6.0	1	СБ-6	3 x 95	230	230	1955	IV	СБ-6 3x183:100(59)
51	5	75	5	236	1	6.0	1	СБ-6	3 x 95	270	270	1955	IV	АСБ-10 3x185:120(77)
52	5	76	1	228	1	6.0	1	СБ-6	3 x 70	270	270	1955	IV	АСБ-10 3x185:120(77)
53	6	86	88	96	1	6.0		СБ-6	3 x 95	200	200	1955	IV	
54	6	175	6	302	1	6.0	1	СБ-6	3 x 95	620	620	1955	IV	АС6,3x150:210(59)
55	6	175	88	96	1	6.0	2	ОСБ-35	3 x 95	584	584	1955	IV	С6,3x185:80(55);3x150:85(65)
56	6	177	6	396	1	6.0	1	СБ-6	3 x 95	530	530	1955	IV	С6,3x50:250(62)
57	4	189	9	232	1	6.0		АСБ-6	3 x 70	510	510	1955	IV	
58	9	197	9	594	1	6.0	1	СБ-6	3 x 95	414	414	1955	IV	АС10,3x185:7(72)
59	9	197	9	823	1	6.0	1	СБ-6	3 x 95	230	230	1955	IV	АА10,3x185:100(85)
60	9	221	9	233	1	6.0	1	СБ-6	3 x 95	440	440	1955	IV	ААШ10,3x150:310(73)
61	6	256	6	302	1	6.0	1	СБ-6	3 x 95	275	275	1955	IV	АС6,3x150:230(59)
62	5	240	5	662	1	6.0	3	СБ-6	3 x 150	696	696	1956	IV	ААБ-10 3 x 185:92(68),АСБ-10 3x240:104(74),АСБ-6 3x185:185(59)
63	5	240	88	220	1	6.0	2	СБ-6	3 x 150	510	510	1956	IV	ААБ-10 3 x 185:93(68),АСБ-10 3x150:105(77)
64	5	265	5	464	1	6.0	2	СБ-6	3 x 95	195	195	1956	IV	СБ-6 3x70:55(56),АСБ-10 3x150:50(80)

Appendix II.3.2-1(3) 6kV & 10kV Underground Cables to be replaced under the M/P in Nasimi

No.	From Network No.	From Station No.	To Network No.	To Station No.	Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
65	5	154	4	783	1	6.0	2	СБ-6	3 x 70	573	573	1957	V	C6,3x95:236(57);AC6,3x95:150(83)
66	5	154	5	155	1	6.0	1	АСБ-6	3 x 185	580	580	1957	V	СБ-6 3x70:180(57)
67	5	158	5	224	1	6.0	1	СБ-6	3 x 70	312	312	1957	V	АСБ-6 3x150:12(87)
68	6	175	6	176	1	6.0		АСБ-6	3 x 120	250	250	1957	V	
69	6	175	6	177	1	6.0		СБ-6	3 x 95	229	229	1957	V	
70	5	224	5	271	1	6.0	1	АСБ-6	3 x 150	433	433	1957	V	АСБ-6 3x150:55(87)
71	6	560	88	96	1	6.0	1	СБ-6	3 x 70	325	325	1957	V	AC10,3x185:85(69)
72	6	67	6	68	1	6.0		СБ-6	3 x 95	635	635	1958	V	
73	6	176	6	178	1	6.0	1	АСБ-6	3 x 95	280	280	1958	V	AC10,3x185:65(68)
74	9	183	9	188	1	6.0	4	АСБ-10	3 x 120	650	650	1958	V	ААБ-6, 3x95 370(58),3x120 135(58),3x95 30(58),ААБ-10,3x120 55(79)
75	9	188	9	395	1	6.0		АСБ-6	3 x 95	160	160	1958	V	
76	5	234	5	492	1	6.0	3	АСБ-6	3 x 185	439	439	1958	V	СБ-6 3x185:74(68),АСБ-10 3x150:160(72),СБ-6 3x70:175(58)
77	5	426	4	463	1	6.0	2	СБ-6	3 x 95	515	515	1958	V	AC6,3x150:90(58);AC10,3x150:515(68)
78	5	426	88	111	1	6.0	1	СБ-6	3 x 95	262	262	1958	V	АСБ-6 3x150:90(63)
79	5	64	5	217	1	6.0	1	АСБ-6	3 x 185	632	632	1959	VI	СБ-6 3x95:250(70)
80	5	93	5	532	1	6.0	1	АСБ-6	3 x 150	120	120	1959	VI	АСБ-10 3x150:55(59)
81	5	173	5	309	1	6.0	1	АСБ-6	3 x 185	790	790	1959	VI	ААШБ-10 3x185:110(79)
82	5	180	5	309	1	6.0	1	АСБ-6	3 x 120	290	290	1959	VI	ААШБ-6 3x120:110(70)
83	9	221	9	313	1	6.0		СБ-6	3 x 95	425	425	1959	VII	
84	5	240	5	532	1	6.0	1	АСБ-6	3 x 150	340	340	1959	VII	АСБ-6 3 x 185:55(60)
85	6	89	6	251	1	6.0	1	АСБ-10	3 x 95	1,050	1,050	1960	VII	AC10,3x185:70(60)
86	6	89	6	772	1	6.0	2	АСБ-6	3 x 185	721	721	1960	VII	AC10,3x150:196(81);AA10,3x185:420(81)
87	6	89	88	96	1	6.0	1	СБ-6	3 x 150	548	548	1960	VII	AC6,3x185:59(60)
88	9	151	9	203	1	6.0		СБ-6	3 x 95	550	550	1960	VII	
89	6	177	6	723	1	6.0	2	СБ-6	3 x 95	626	626	1960	VII	C6,3x185:350(60);AC10,3x240:110(60)
90	9	199	9	232	1	6.0		АСБ-6	3 x 120	800	800	1960	VII	
91	9	203	9	233	1	6.0		АСБ-6	3 x 95	600	600	1960	VII	
92	9	203	9	313	1	6.0		СБ-6	3 x 95	270	270	1960	VIII	
93	9	203	9	336	1	6.0		АСБ-6	3 x 95	110	110	1960	VIII	
94	5	223	5	225	1	6.0	1	АСБ-10	3 x 120	250	250	1960	VIII	АСБ-6 3x185:210(60)
95	6	323	6	478	1	6.0	2	АСБ-6	3 x 240	615	615	1960	VIII	АСБ-6 3x185:160(60),АСБ-6 3x185:90(60)
96	5	334	5	492	1	6.0	2	АСБ-6	3 x 185	112	112	1960	VIII	АСБ-10 3x185:70(69),АСБ-6 3x185:22(79)
97	5	334	88	117	1	6.0	2	АСБ-6	3 x 185	476	476	1960	VIII	АСБ-10 3x185:21(79),АСБ-10 3x185:435(69)
98	6	345	6	522	1	6.0	2	АСБ-10	3 x 185	285	285	1960	VIII	СБ-6 3x185:145(60),СБ-6 3x150:15(67)
99	6	345	9	835	1	6.0		СБ-6	3 x 95	190	190	1960	VIII	
100	6	345	88	111	1	6.0		СБ-6	3 x 95	290	290	1960	VIII	
101	9	380	9	470	1	6.0	1	АСБ-6	3 x 185	562	562	1960	VIII	AC10,3x185:222(64)
102	9	381	9	470	1	6.0	1	АСБ-6	3 x 185	267	267	1960	VIII	AC10,3x185:222(64)
103	6	478	88	96	1	6.0		АСБ-6	3 x 240	155	155	1960	VIII	
104	6	522	6	723	1	6.0	1	СБ-6	3 x 185	410	410	1960	VIII	АСБ-10 3x240:110(78)
105	6	835	88	111	1	6.0		СБ-6	3 x 95	100	100	1960	VIII	
106	5	62	5	325	1	10.0		СБ-6	3 x 185	130	130	1960	VIII	СБ-6 3x95:80(60)
Subtotal of before 1960					107					45,261	46,441			
(with 2 or more joints cable)														
107	5	228	5	309	1	6.0	2	АСБ-6	3 x 185	500	500	1961	VIII	ААШБ-10 3x185:110(74),АСБ-10 3x185:110(76)
108	6	229	6	838	1	6.0	2	СБ-6	3 x 95	395	395	1961	VIII	СБ-6 3x70:250(38),ААБ-10 3x185:30(87)
109	5	94	5	553	1	6.0	2	АСБ-6	3 x 185	1,270	1,270	1962	VIII	ААШБ-10 3x185:420(78),ААБ-10 3x185:130(71)
110	9	434	9	440	1	10.0	2	СБ-6	3 x 95	680	680	1963	IX	AC6,130(63);AC10,3x150:370(74)
111	9	434	9	740	1	10.0	2	АСБ-6	3 x 150	290	290	1963	IX	АСБ-10,3x150:60(78),АСБ-10,3x150:50(78)
112	90	2060	88	95	2	6.0	2	АСБ-10	3 x 185	1,595	3,190	1964	IX	АСБ-10 3x185:1050(74),445(81)
113	4	189	88	111	1	6.0	3	СБ-6	3 x 150	1,380	1,380	1965	IX	ААБ-10 3x185:730(67),АСБ-6,3x150:150(65);220(67)
114	6	150	6	231	1	6.0	2	АСБ-6	3 x 185	355	355	1966	IX	ААШ10,3x185:140(82),СБ-6 3x70:130(54)
115	9	434	9	740	1	10.0	2	АСБ-10	3 x 120	220	220	1969	IX	АСБ-10,3x150:30(78),АСБ-10,3x150:50(78)
116	9	611	9	612	2	10.0	2	ААБ-10	3 x 185	370	740	1969	IX	AA10,3x150:60(71);AC10,3x185:42(85)
117	5	24	5	234	1	10.0	2	АСБ-10	3 x 185	475	475	1972	IX	АСБ-10 3 x 185:10(85),АСБ-10 3 x 185:190(72)
118	6	31	6	780	2	10.0	2	АСБ-10	3 x 150	2,037	4,074	1977	X	АСБ-10 3x185:100(83),АСБ-10 3x240:737(84)
119	5	93	5	94	1	6.0	2	СБ-6	3 x 70	567	567	1978	X	СБ-6 3x70:257(78),ААШБ-10 3x185:40(78)
120	5	81	5	450	1	6.0	2	АСБ-10	3 x 150	840	840	1980	X	АСБ-10 3x185:270(89),АСБ-10 3x240:150(74)
Subtotal of with 2 or more joints cable					17					10,974	14,976			
(use 6kV cable)														
121	9	397	9	633	1	10.0	1	АСБ-6	3 x 185	166	166	1962	X	AA10,3x185:116(74)
122	9	408	9	421	1	10.0		АСБ-6	3 x 120	273	273	1963	X	
123	9	432	9	440	1	10.0		СБ-6	3 x 95	275	275	1963	X	
124	9	209	9	440	1	10.0		ААБ-6	3 x 185	250	250	1964	X	
125	9	209	9	449	1	10.0		АСБ-6	3 x 120	230	230	1964	X	

Appendix II.3.2-1(3) 6kV & 10kV Underground Cables to be replaced under the M/P in Nasimi

No.	From		To		Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
	Network No.	Station No.	Network No.	Station No.										
126	9	449	9	459	1	10.0		АСБ-6	3 x 120	130	130	1964	X	
127	9	449	9	461	1	10.0		АСБ-6	3 x 150	300	300	1964	X	
Итого до используются 6КВ-ные кабельн					41					23,572	31,576			
Total					165					79,807	92,993			

Appendix II.3.2-1(4) 6kV & 10kV Underground Cables to be replaced under the M/P in Narimanov

No.	From		To		Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
	Network No.	Station No.	Network No.	Station No.										
(before 1960)														
1	7	70	7	701	2	6.0	3	СБ-6	3 x 50	500	1,000	1926	I	C6,3x70:80(56);3x95:60(32);3x150:50(76)
2	7	91	7	701	1	6.0	2	СБ-6	3 x 50	720	720	1926	I	C6,3x50:540(27);AC10,3x150:50(76)
3	7	91	7	262	1	6.0		СБ-6	3 x 70	645	645	1936	II	
4	6	251	6	252	1	6.0	1	СБ-6	3 x 120	150	150	1936	II	СБ-6,3x95:40(68)
5	7	127	7	756	1	6.0	1	СБ-6	3 x 50	365	365	1940	II	ААШ10,3x150:80(79)
6	7	756	88	227	1	6.0	2	СБ-6	3 x 50	455	455	1940	II	ААШ10,3x150:110(79);AC6,3x185:260(--)
7	7	572	88	227	2	6.0	2	СБ-6	3 x 185	555	1,110	1941	II	АСБ-10 3x185:280(79),ААШБ-10 3x185:105(70)
8	6	363	6	623	1	6.0	2	СБ-6	3 x 50	392	392	1949	II	АСБ-10 3x150:135(73),АСБ-6 3x95:345(61)
9	7	127	7	757	1	6.0	1	СБ-6	3 x 70	130	130	1950	II	AA10,3x185:30(81)
10	7	163	7	164	1	6.0	1	СБ-6	3 x 50	523	523	1950	II	AC6,3x50:43(58)
11	7	165	7	757	1	6.0	1	СБ-6	3 x 70	355	355	1950	III	AA10,3x185:30(81)
12	7	166	7	406	1	6.0	2	АСБ-6	3 x 95	690	690	1950	III	AC6,3x95:385(58);3x185:175(62)
13	6	182	6	256	1	6.0	2	СБ-6	3 x 95	563	563	1950	III	C10,3x185:42(50);AC10,3x150:85(65)
14	7	128	7	163	1	6.0	1	СБ-6	3 x 70	499	499	1952	III	C6,3x95:105(57)
15	6	211	6	315	1	6.0	1	СБ-6	3 x 95	308	308	1953	III	C6,3x185:192(59)
16	6	211	6	390	1	6.0		СБ-6	3 x 95	75	75	1953	III	
17	7	161	6	315	1	6.0	5	СБ-6	3 x 95	753	753	1954	III	C6,3x185:177(54);AC10,3x185:50(65);[illegible];АСБ-10,3x150:135(54)
18	6	171	6	668	1	6.0	2	АСБ-6	3 x 95	330	330	1954	IV	AC10,3x150:67(75);3x185:55(75)
19	6	171	6	488	1	6.0	2	СБ-6	3 x 70	595	595	1954	IV	СБ-6 3x95:95(54),ААБЛ-10 3x185:340(89)
20	7	205	7	308	1	6.0	2	СБ-6	3 x 70	255	255	1954	IV	C6,3x185:90(59);AC6,3x185:60(59)
21	7	74	7	262	1	6.0	2	СБ-6	3 x 70	415	415	1955	IV	C6,3x95:22(55),AC10,3x150:125(--)
22	7	168	7	264	1	6.0	1	СБ-6	3 x 70	165	165	1955	IV	C6,3x70:80(--)
23	9	185	6	488	1	6.0	1	СБ-6	3 x 95	330	330	1955	IV	AA10,3x120:230(89)
24	9	185	9	594	1	6.0	1	СБ-6	3 x 95	783	783	1955	IV	AC10,3x185:4(72)
25	7	202	7	3312	1	6.0		СБ-6	3 x 70	755	755	1955	IV	
26	7	219	7	312	1	6.0	2	СБ-6	3 x 70	295	295	1955	IV	C6,3x95:50(59);AA10,3x185:100(90)
27	7	264	7	375	1	6.0	2	СБ-6	3 x 70	1,785	1,785	1955	IV	C6,3x95:125(59);AC6,3x185:420(61)
28	6	171	6	475	1	6.0	2	СБ-6	3 x 95	243	243	1956	IV	AC6,3x185:73(65);AC10,3x185:110(75)
29	7	202	6	267	1	6.0		СБ-6	3 x 70	997	997	1956	IV	
30	6	268	6	458	1	6.0	1	СБ-6	3 x 95	393	393	1956	IV	АСБ-6 3x95:40(68)
31	7	308	7	503	1	6.0	3	СБ-6	3 x 70	650	650	1956	IV	AC6,3x95:85(58);AA10,3x150:90(66);C6,3x70:145(66)
32	6	455	6	458	1	6.0	1	СБ-6	3 x 95	367	367	1956	IV	AA10,3x150:180(72)
33	7	91	7	128	1	6.0		СБ-6	3 x 95	505	505	1957	V	
34	6	140	6	317	1	6.0	2	СБ-6	3 x 70	305	305	1957	V	C6,3x95:20(59);AC6,3x95:200(59)
35	6	140	6	560	1	6.0	1	СБ-6	3 x 70	595	595	1957	V	AC10,3x185:85(69)
36	6	194	6	317	1	6.0	1	СБ-6	3 x 70	390	390	1957	V	АСБ-6 3x95:200(59)
37	7	202	6	343	1	6.0	3	СБ-6	3 x 95	1,160	1,160	1957	V	AC6,3x185:230(60);AA10,3x150:[illegible](66);AC10,3x185:450(66)
38	7	202	88	227	1	6.0		СБ-6	3 x 95	1,350	1,350	1957	V	
39	6	458	88	96	1	6.0	2	СБ-6	3 x 150	1,138	1,138	1957	V	AC6,3x240:155(60);AC10,3x185:43(70)
40	6	708	88	96	1	6.0	1	СБ-6	3 x 150	690	690	1957	V	АСБ-10 3x185:90(73)
41	7	74	7	701	1	6.0	2	СБ-6	3 x 95	377	377	1958	VI	AC10,3x150:85(76);175(88)
42	7	91	7	152	1	6.0	1	СБ-6	3 x 95	185	185	1958	VI	AC10,3x150:135(75)
43	7	152	7	572	1	6.0	2	СБ-6	3 x 95	400	400	1958	VI	AC10,3x150:200(74);150(75)
44	7	163	7	663	1	6.0	2	АСБ-6	3 x 95	410	410	1958	VI	AC6,3x185:60(59);AA10,3x150:200(89)
45	6	182	9	183	1	6.0	4	АСБ-6	3 x 185	850	850	1958	VI	[illegible]
46	6	186	6	773	1	6.0		АСБ-10	3 x 95	360	360	1958	VI	
47	6	187	6	254	1	6.0	1	АСБ-6	3 x 95	660	660	1958	VI	AC6,3x185:410(63)
48	6	187	6	268	1	6.0		АСБ-6	3 x 95	240	240	1958	VI	
49	6	190	6	374	1	6.0		СБ-6	3 x 70	430	430	1958	VI	
50	6	254	6	773	1	6.0	1	АСБ-10	3 x 95	460	460	1958	VI	AC10,3x185:410(63)
51	7	264	7	406	1	6.0	1	АСБ-6	3 x 95	505	505	1958	VI	AC6,3x185:175(62)
52	7	346	7	569	1	6.0	2	АСБ-6	3 x 70	550	550	1958	VI	AC6,3x95:215(67) ; AC10,3x185:35(69)
53	7	278	7	318	1	10.0	1	СБ-6	3 x 50	204	204	1958	VI	C6,3x70:147(60),
54	7	278	7	377	1	10.0	2	СБ-6	3 x 70	455	455	1958	VI	AC6,3x185:110(60)AA10,3x185:165(69)
55	7	294	7	319	1	10.0	1	СБ-6	3 x 50	533	533	1958	VI	AC6,3x95:110(59)
56	7	318	7	319	1	10.0	2	СБ-6	3 x 50	275	275	1958	VI	C6,3x70:145(60);AC6,3x95:110(59)
57	7	159	7	160	1	6.0	2	АСБ-6	3 x 185	380	380	1959	VII	C10,3x185:80(59)ААШ10,3x185:160(75)
58	7	161	6	328	1	6.0	1	АСБ-6	3 x 185	350	350	1959	VII	AC10,3x185(74)
59	6	211	6	316	1	6.0	1	АСБ-6	3 x 185	700	700	1959	VII	AA,3x150:87(66)
60	7	282	7	387	1	6.0	1	СБ-6	3 x 185	800	800	1959	VII	AC6,3x185:300(62)
61	7	308	7	406	1	6.0	1	АСБ-6	3 x 95	975	975	1959	VII	AC6,3x185:285(62)
62	6	316	6	328	1	6.0	1	АСБ-6	3 x 185	210	210	1959	VII	AC10,3x185:45(88)
63	6	617	7	663	1	6.0	2	АСБ-6	3 x 120	430	430	1959	VII	АСБ-6 3x150:30(86),ААБ-10 3x150:200(89)
64	7	63	7	74	1	6.0	1	СБ-6	3 x 95	390	390	1960	VIII	AC10,3x150:150(88)

Appendix II.3.2-1(4) 6kV & 10kV Underground Cables to be replaced under the M/P in Narimanov

No.	From Network No.	From Station No.	To Network No.	To Station No.	Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
65	7	63	6	617	1	6.0	1	АСБ-6	3 x 150	250	250	1960	VIII	АС6,3x150:60(86)
66	7	133	7	639	1	6.0	2	СБ-6	3 x 150	237	237	1960	VIII	АС6,3x185:30(62);АС10,3x185:115(74)
67	7	166	7	402	1	6.0	2	АСБ-6	3 x 185	130	130	1960	VIII	АС6,3x150:25(62);АА10,3x120:40(89)
68	6	194	6	343	1	6.0		АСБ-6	3 x 120	227	227	1960	VIII	
69	7	205	7	287	1	6.0		АСБ-6	3 x 120	325	325	1960	VIII	
70	6	213	6	374	1	6.0	2	АСБ-6	3 x 95	1,536	1,536	1960	VIII	СБ-6 3x70:320(58),АСБ-6 3x150:16(61)
71	7	219	7	344	1	6.0		АСБ-6	3 x 120	600	600	1960	VIII	
72	7	280	7	282	1	6.0		АСБ-6	3 x 120	460	460	1960	VIII	
73	7	280	7	346	1	6.0	1	АСБ-6	3 x 185	850	850	1960	VIII	АА10,3x185:450(95)
74	7	281	7	346	1	6.0	1	АА-10	3x185	450	450	1960	VIII	АА10,3x185:100(--)
75	7	282	7	284	1	6.0	1	СБ-6	3 x 50	480	480	1960	VIII	АС6,3x185:310(60)
76	7	284	88	227	1	6.0		АСБ-6	3x120	1,040	1,040	1960	VIII	
77	7	287	7	356	1	6.0	1	АСБ-6	3 x 150	623	623	1960	VIII	АС6,3x185:218(61)
78	7	253	7	403	1	10.0	2	АСБ-6	3 x 150	215	215	1960	VIII	СБ-10 3x150:50(67),АСБ-10 3x150:180(80)
79	7	253	7	456	1	10.0	1	АСБ-6	3 x 150	625	625	1960	VIII	АСБ-10 3x150:180(80)
80	7	278	7	404	1	10.0	2	АСБ-6	3 x 150	655	655	1960	VIII	АС10,3x150:385(69);С10,3x95:60(71)
81	7	286	7	339	1	10.0		АСБ-10	3 x 120	400	400	1960	VIII	
Subtotal of before 1960					**83**					**42,401**	**43,456**			
(with 2 or more joints cable)														
82	7	350	7	356	1	6.0	2	АСБ-10	3 x 185	381	381	1961	VIII	АС10,3x150:60(74);АА10,3x150:160(74)
83	7	365	7	402	1	6.0	3	АСБ-6	3 x 150	508	508	1962	VIII	АС6,3x185:365(62);АС10,3x185:70(75);АА10,3x120:50(89)
84	7	392	7	618	1	10.0	2	ААБ-10	3 x 185	595	595	1964	IX	ААШ10,3x185:45(76);АА10,3x185:220(73)
85	7	392	7	618	1	10.0	2	ААБ-10	3 x 185	595	595	1964	IX	ААШ10,3x185:45(76);АА10,3x185:220(73)
86	6	431	6	537	1	6.0	2	АСБ-6	3 x 185	402	402	1964	IX	АА10,3x150:175(67);3x185:75(67)
87	6	196	6	488	1	6.0	2	АСБ-6	3 x 185	432	432	1965	IX	СБ-6 3x3x150:250(66),АСБ-6 3x95:170(58)
88	6	772	88	227	1	6.0	3	АСБ-10	3 x 185	1,365	1,365	1965	IX	АСБ-10 3x150:105(84),АСБ-10 3x185:300(78),АСБ-10 3x185:350(80)
89	7	70	6	515	1	6.0	2	АСБ-6	3 x 150	200	200	1966	IX	АА10,3x185:160(65);105(75)
90	6	559	7	644	1	10.0	2	АСБ-10	3 x 150	1,110	1,110	1973	IX	ААБ-10 3 x 150:80(73),АСБ-10 3x95:60(74)
91	7	366	7	644	1	10.0	2	СБ-10	3 x 95	1,080	1,080	1974	IX	АС10,3x150:920(73);100(74)
Subtotal of with 2 or more joints cable					**10**					**6,668**	**6,668**			
(use 6kV cable)														
92	7	311	7	333	1	10.0		АСБ-6	3 x 120	430	430	1961	X	
93	7	333	7	368	1	10.0		АСБ-6	3 x 120	280	280	1961	X	
94	7	366	7	368	1	10.0		АСБ-6	3 x 150	310	310	1961	X	
95	7	367	7	556	1	10.0	1	АСБ-6	3 x 185	160	160	1961	X	АС6,3x150:1010(69)
96	7	367	7	404	1	10.0		АСБ-6	3 x 120	316	316	1962	X	
97	7	392	7	456	1	10.0	1	АСБ-6	3 x 95	170	170	1962	X	АС10,3x185:40(76)
98	7	404	7	405	1	10.0		АСБ-6	3 x 120	316	316	1962	X	
99	7	405	7	474	1	10.0	1	АСБ-6	3 x 185	643	643	1962	X	АС10,3x185:276(65)
100	6	431	6	441	1	10.0	1	АСБ-6	3 x 150	458	458	1964	X	АСБ-6 3x185:338(64)
Subtotal of use 6kV cable					**9**					**3,083**	**3,083**			
Total					**102**					**52,152**	**53,207**			

Appendix II.3.2-1(5) 6kV & 10kV Underground Cables to be replaced under the M/P in Nizami

No.	From		To		Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
	Network No.	Station No.	Network No.	Station No.										
(befpre 1960)														
1	8	20	8	21	1	10.0		АСБ-6	3 x 120	410	410	1948	II	
2	8	21	8	23	1	10.0		АСБ-6	3 x 70	369	369	1953	III	
3	8	21	8	31	1	10.0		АСБ-6	3 x 120	225	225	1953	III	
4	8	31	8	32	1	10.0		АСБ-6	3 x 120	225	225	1953	III	
5	8	32	8	33	1	10.0		АСБ-6	3 x 95	460	460	1953	III	
6	8	29	8	33	1	10.0		АСБ-6	3 x 95	735	735	1955	IV	
7	8	35	8	37	1	10.0		АСБ-6	3 x 95	200	200	1957	V	
8	8	25	8	27	1	10.0	1	СБ-6	3 x 50	322	322	1958	VI	АС Б -10 3x150:62(77)
9	8	29	8	41	1	10.0		АСБ-6	3 x 70	770	770	1958	VI	
10	8	35	8	36	1	10.0		АСБ-6	3 x 95	200	200	1958	VI	
11	8	2	8	7	2	10.0		АСБ-6	3 x 150	300	600	1960	VIII	
Subtotal of before 1960					12					4,216	4,516			
(with 2 or more joints cable)														
12	8	14	8	37	1	10.0	2	АСБ-10	3 x 95	486	486	1961	VIII	АСБ-10 3x150:240(69),96(87)
13	8	66	8	75	1	10.0	2	АСБ-10	3 x 185	480	480	1965	IX	ЦАСБ-10 3x70:30(72),ААШБ-10 3x95:150(71)
14	8	66	8	78	1	10.0	2	АСБ-10	3 x 185	1,200	1,200	1965	IX	ЦАС Б -10 3x70:30(72),ААШ Б -10 3x95:150(71)
15	8	18	88	212	1	10.0	2	АСБ-10	3 x 150	731	731	1971	IX	АС Б -10 3x120:386(83);ААШ Б -10 3x120:75(95)
16	8	84	88	212	1	10.0	2	АСБ-10	3 x 120	315	315	1989	X	ААБ-10 3x185:120(89),ААБ-10 3x120:75(95)
Subtotal of with 2 or more joints cable					5					3,212	3,212			
(use 6kV cable)														
17	8	11	8	20	1	10.0		АСБ-6	3 x 70	450	450	1963	X	
18	8	22	8	31	1	10.0		АСБ-6	3 x 70	140	140	1964	X	
19	8	22	8	52	1	10.0	1	АСБ-6	3 x 70	190	190	1964	X	ААБ-10 3x95:30(68)
20	8	52	8	56	1	10.0		АСБ-6	3 x 70	400	400	1964	X	
21	8	53	8	55	1	10.0		АСБ-6	3 x 70	730	730	1964	X	
22	8	56	8	58	1	10.0		АСБ-6	3 x 120	650	650	1964	X	
23	8	1	8	3	1	10.0	1	АСБ-6	3 x 185	875	875	1965	X	ААБ-10 3x185:400(82)
24	8	1	8	16	1	10.0	1	АСБ-6	3 x 185	435	435	1965	X	ААБ-10 3x185:85(70)
25	8	4	8	5	1	10.0		АСБ-6	3 x 150	255	255	1965	X	
26	8	5	8	6	1	10.0	1	АСБ-6	3 x 150	520	520	1965	X	ААШБ-10 3x120:220(85)
27	8	5	8	76	1	10.0		АСБ-6	3 x 150	150	150	1965	X	
28	8	11	8	17	1	10.0		СБ-6	3 x 95	400	400	1965	X	
29	8	28	8	41	1	10.0		АСБ-6	3 x 70	370	370	1965	X	
30	8	29	8	46	1	10.0		АСБ-6	3 x 50	512	512	1965	X	
31	8	76	8	77	1	10.0		АСБ-6	3 x 120	573	573	1965	X	
32	8	77	8	78	1	10.0		АСБ-6	3 x 185	360	360	1965	X	
33	8	8	8	31	1	10.0		АСБ-6	3 x 70	350	350	1967	X	
Subtotal of use 6kV cable					17					7,360	7,360			
Total					34					14,788	15,088			

Appendix II.3.2-1(6) 6kV & 10kV Underground Cables to be replaced under the M/P in Khatai

No.	From		To		Num. Of Circuit (CCT)	Voltage (kV)	Joint	Cable Type	Cable Size	Route Length (m)	Cable Length (cct·m)	Commiss. Year	Priority	Remarks
	Network No.	Station No.	Network No.	Station No.										
(before 1960)														
1	13	291	88	1902	1	10.0	3	АСБ-10	3 x 120	1,200	1,200	1936	II	ААБ-10 3x185:236(75),ААБ-10 3x150:300(85),ААБ-10 3x120:644(56)
2	13	318	13	319	2	10.0		АСБ-10	3 x 95	610	1,220	1958	VI	
Subtotal of before 1960					**3**					**1,810**	**2,420**			
(with 2 or more joints cable)														
3	13	290	13	291	1	10.0	2	ААБ-10	3 x 150	360	360	1975	IX	ААШБ-10 3x150:310(79)
4	13	333	88	1902	1	10.0	2	АСБ-10	3 x 240	1,770	1,770	1976	IX	АСБ-10 3 x 240:150(86),АСБ-10 3 x 185:1,620(76)
5	13	200	13	202	1	10.0	2	АСБ-10	3 x 185	600	600	1977	X	ААБ-10 3x185:90(82),АСБ-10:70(82)
6	13	202	88	1902	1	10.0	2	АСБ-10	3 x 185	1,840	1,840	1977	X	АСБ-10 3x185:90(82),АСБ-10 3x95:70(82)
Subtotal of with 2 or more joints cable					**4**					**4,570**	**4,570**			
Total					**7**					**6,380**	**6,990**			

Appendix II.3.3-1 Transformer station using the bulk oil circuit breaker

No.	Tr.Station No.	Network Area	Bulk-Oil Type CB Model	Nos.	Manuf. Year	District Name	Remarks
(Sabail District)				35			
1	5	2	AESH-200	2	1938	Sabail	
			VM-16600	2	1938		
2	6	2	VM-5200	1	1938	Sabail	
			VM-10600	1	1938		
3	7	2	AESH-1	1	1937	Sabail	
			VM-14	1	1937		
4	8	2	VMb-10	3	1949	Sabail	
5	17	2	VM-22	1	1946	Sabail	
6	20	2	VM-14200	1	1939	Sabail	
7	23	2	VM-22400	1	1939	Sabail	
			VM-14600	1	1939		
8	33	2	VM-14200	1	1930	Sabail	
9	34	3	VMb-10	5	1955	Sabail	
10	41	2	VMb-10	3	1928/34	Sabail	
11	53	2	VMb-400	1	1938	Sabail	
12	60	5	VVb-200	1	1932	Sabail	
			VMb-400	1	1959		
			VM-14400	1	1939		
			VMb-400	1	1940		
13	101	1		1		Sabail	
14	129	2	VM-5200	1	1936	Sabail	
15	200	2	VM-22	3	1939	Sabail	
16	393	1		1		Sabail	
(Yasamal District)				27			
1	18	3	VM-14	1	1940	Yasamal	
2	19	3	VMb-10	3	1940	Yasamal	
3	26	2	AESH-200	4	1935	Yasamal	
4	27	3	AESH-200	1	1939	Yasamal	
			VM-14	1	1939		
			VMb-10	2	1939		
5	29	4	AEG-200	1	1930	Yasamal	
			VM-16600	1			
			AEG-200	1			
6	35	3	AEG	2	1935	Yasamal	
			VM-14	2	1935		
7	38	3	AEG-200	1	1938	Yasamal	
			VMb-10	1	1938		
8	39	4		2		Yasamal	
9	104	4	VMb-10	1	1947	Yasamal	
10	114	4	VMb-10	1	1947	Yasamal	
11	132	4		1		Yasamal	
12	222	4	VMb-10	1	1958	Yasamal	
(Nasimi District)				22			
1	15	2	VM-12	1	1941	Nasimi	
2	44	2	VMb-400	1	1938	Nasimi	
			VMb-10	1	1953		
3	47	3	VMb-10	1	1970	Nasimi	
			VM-2	1	1935		
4	48	3	VM-14	1	1935	Nasimi	
			AEG-200	1	1935		
			VM-12	1	1937		
			VMb-10	1	1970		
5	50	3	VMb-10	2	1953	Nasimi	
6	58	3	VMb-200	1	1928	Nasimi	10kV
7	68	6	VMb-10	2		Nasimi	
8	93	5	VM-14400	1	1936	Nasimi	
			VM-14	1	1934		
			VMb-10	1	1938		
9	175	6		3		Nasimi	
			VMb-10	1	1930		
10	302	6		1		Nasimi	
(Narimanov District)				5			
1	211	6		3		Narimanov	
2	212			2		Narimanov	
Grand Total				89			

Source : BEN

Appendix II.3.3-2(1) 6kV & 10kV Transformer Stations to be rehabilitated under the M/P in Sabail

No.	Tr.station No.	Transformers Unit (nos)	Unit Cap. (kVA)	Total Cap. (kVA)	Primary Voltage (kV)	Type of Station	Num. of Panel (nos)	Circuit Breaker (nos)	Comms. Year of Tr. St	Network Area	Comms. Year of UG Cables	Priority
1	5	2	400+630	1,030	6.0	KP	7	3	1940	2	1933	I
2	6	1	630	630	6.0	KB	4	1	1938	2	1933	I
3	7	2	250+400	650	6.0	KP	8	3	1937	2	1933	I
4	8	2	400+630	1,030	6.0	KO	6	3	1948	2	1952	I
5	17	2	400+630	1,030	6.0	KP	6	2	1953	2	1932	I
6	20	1	400	400	6.0	KB	5	1	1939	2	1910	I
7	23	2	400	800	6.0	KB	8	4	1934	2	1910	I
8	33	2	320+630	950	6.0	KP	5	1	1930	2	1929	I
9	34	2	630	1,260	6.0	KO	6	5	1955	3	1913	I
10	41	1	400	400	6.0	KB	5	2	1928	2	1959	I
11	60	1	400	400	6.0	KO	2	0	1937	5	1931	I
12	101	1	400	400	6.0	KO	4	2	1950	1	1960	II
13	129	0	-	0	6.0	KB	4	2	1932	2	1910	II
14	200	2	630	1,260	6.0	KO	6	3	1939	2	1940	II
15	393	1	630	630	6.0	KO	4	1	1962	1	1962	II
16	2	1	630	630	6.0	KO	7	6	1920	1	1910	II
17	10	1	320	320	6.0	KO	4	2	1964	1	1912	II
18	32	4	3x320+560	1,520	6.0	KO	6	5	1940	1	1912	II
19	354	1	320	320	6.0	KB	4	3	1961	1	1928	II
20	348	2	630	1,260	6.0	KB	5	1	1962	2	1928	II
21	53	1	315	315	6.0	KB	3	1	1938	2	1930	III
22	98	0	-	0	6.0	KB	1	0	1934	5	1931	III
23	60	2	400+630	1,030	10.0	KO	7	4	1937	5	1931	III
24	98	2	400	800	10.0	KB	6	2	1934	5	1931	III
25	519	1	630	630	6.0	KO	7	2	1966	2	1932	III
26	22	1	400	400	6.0	KB	4	0	1966	2	1933	III
27	201	1	320	320	6.0	KO	3	0	1937	2	1940	III
28	57	2	630	1,260	6.0	KO	4	4	1948	5	1948	III
29	411	2	400+320	720	6.0	KB	6	4	1952	5	1948	III
30	49	2	320	640	6.0	KB	2	0	1952	5	1949	III
31	77	2	320	640	6.0	KB	6	4	1952	5	1949	III
32	291	1	630	630	6.0	KB	4	3	1961	2	1952	IV
33	462	1	400	400	6.0	PMT	2	0	1964	2	1954	IV
34	11	2	400+630	1,030	6.0	KB	5	2	1955	2	1954	IV
35	236	2	560+630	1,190	6.0	KB	5	3	1950	5	1955	V
36	4	1	400	400	6.0	KP	4	0	1960	2	1957	VI
37	107	1	400	400	6.0	PMT	3	0	1960	2	1957	VI
38	301	2	630	1,260	6.0	KO	7	2	1964	2	1957	VI
39	103	1	400	400	6.0	PMT	4	1	1959	1	1958	VII
40	453	1	320	320	6.0	KO	4	2	1964	1	1958	VII
41	550	1	320	320	6.0	KO	4	1	1970	1	1958	VII
42	105	1	400	400	6.0	KB	4	2	1958	1	1958	VII
43	321	2	400+630	1,030	6.0	KO	6	2	1958	2	1959	VIII
44	102	1	320	320	6.0	KO	3	1	1958	1	1959	VIII
45	476	1	320	320	6.0	KO	4	1	1965	1	1959	VIII
46	247	1	320	320	6.0	KO	5	2	1953	1	1959	VIII
47	179	1	400	400	6.0	KB	4	1	1960	5	1959	VIII
48	320	0	-	0	6.0	KB	3	1	1957	5	1959	VIII
49	322	1	250	250	6.0	PMT	3	0	1959	1	1959	VIII
50	325	1	630	630	10.0	KB	4	2	1962	5	1960	IX
Total		**69**		**31,695**			**233**	**97**				

Appendix II.3.3-2(2) 6kV & 10kV Transformer Stations to be rehabilitated under the M/P in Yasamal

No.	Tr.station No.	Transformers Unit (nos)	Unit Cap. (kVA)	Total Cap. (kVA)	Primary Voltage (kV)	Type of Station	Num. of Panel (nos)	Circuit Breaker (nos)	Comms. Year of Tr. St	Network Area	Comms. Year of UG Cables	Priority
1	18	1	400	400	6.0	KB	3	1	1940	3	1935	I
2	19	1	630	630	6.0	KO	4	3	1940	3	1933	I
3	26	1	630	630	6.0	KB	6	3	1935	2	1928	I
4	27	2	400+630	1,030	6.0	KP	8	3	1939	3	1933	I
5	29	2	630	1,260	6.0	KB	5	3	1930	4	1935	I
6	35	1	400	400	6.0	KP	4	2	1935	3	1929	I
7	38	2	630	1260	6.0	KO	5	2	1938	3	1951	I
8	39	2	320	640	6.0	KO	6	2	1946	4	1953	I
9	104	1	630	630	6.0	KO	3	1	1949	4	1952	II
10	114	1	630	630	6.0	KO	3	1	1956	4	1957	II
11	132	1	1,000	1000	6.0	KO	4	2	1951	4	1954	II
12	222	2	400+630	1,030	6.0	KO	7	4	1956	4	1935	II
13	16	1	630	630	6.0	KP	3	1	1942	3	1929	III
14	28	2	400+630	1,030	6.0	KP	8	4	1961	3	1929	III
15	85	1	630	630	6.0	KO	8	6	1936	3	1936	III
16	83	2	320	640	6.0	KO	6	2	1966	4	1936	III
17	378	1	630	630	6.0	KB	4	1	1936	4	1936	III
18	99	2	630	1,260	6.0	KO	6	2	1946	4	1952	IV
19	123	2	630+400	1030	6.0	KO	6	2	1968	4	1952	IV
20	235	1	630	630	6.0	KO	4	1	1956	4	1952	IV
21	383	1	320	320	6.0	KB	4	2	1958	4	1953	IV
22	529	1	320	320	6.0	KO	4	3	1953	4	1953	IV
23	14	1	320	320	6.0	KO	4	1	1958	3	1954	IV
24	30	3	2x560+630	1,750	6.0	KO	7	2	1968	4	1954	IV
25	206	1	400	400	6.0	KB	4	1	1954	4	1954	V
26	296	1	630	630	6.0	PMT	3	0	1957	4	1954	V
27	423	1	400	400	6.0	PMT	3	0	1963	4	1954	V
28	134	1	630	630	6.0	KO	5	2	1940	4	1954	V
29	472	1	630	630	6.0	KO	4	1	1965	4	1954	V
30	137	1	560	560	6.0	KO	5	2	1954	4	1954	V
31	551	2	400	800	6.0	KO	6	2	1969	3	1955	V
32	342	1	1,000	1,000	6.0	KO	4	2	1962	4	1955	V
33	124	3	320+2x400	1,120	6.0	KB	7	5	1962	3	1955	V
34	273	1	400	400	6.0	KB	4	1	1956	3	1955	V
35	144	2	250+560	810	6.0	KB	4	2	1950	4	1955	V
36	289	1	560	560	6.0	KO	4	1	1958	3	1955	V
37	277	1	250	250	6.0	KO	4	2	1969	4	1955	V
38	288	2	400	800	6.0	KO	8	5	1962	4	1955	V
39	385	1	400	400	6.0	KO	4	1	1962	4	1955	V
40	207	1	320	320	6.0	KO	4	1	1954	4	1956	VI
41	90	1	320	320	6.0	KO	4	0	1951	3	1957	VI
42	272	1	630	630	6.0	KO	4	2	1962	3	1957	VI
43	216	1	560	560	6.0	KO	4	0	1958	4	1957	VI
44	118	1	320	320	6.0	KB	6	5	1960	3	1957	VI
45	121	2	320+400	720	6.0	KO	6	3	1956	3	1957	VI
46	391	1	1,000	1000	6.0	KO	5	2	1963	3	1957	VI
47	174	1	320	320	6.0	KB	5	1	1954	4	1957	VI
48	506	2	320	640	6.0	KO	6	2	1966	4	1957	VI
49	208	2	560+630	1190	6.0	KO	7	4	1958	3	1957	VI
50	394	6	x320+2x56	2400	6.0	KO	13	8	1962	3	1957	VII
51	135	1	630	630	6.0	PMT	3	0	1958	4	1958	VII
52	477	1	320	320	6.0	KO	4	2	1965	3	1958	VII
53	92	1	630	630	6.0	KB	3	0	1956	4	1958	VII
54	299	1	630	630	6.0	KO	4	3	1958	3	1958	VII
55	398	2	630	1260	6.0	PMT	6	3	1962	4	1958	VII
56	297	1	400	400	6.0	KO	6	4	1962	3	1958	VII
57	347	1	320	320	6.0	KO	4	0	1966	4	1958	VII
58	290	1	400	400	6.0	KB	4	2	1958	3	1958	VII
59	457	1	560	560	6.0	KO	4	1	1964	3	1958	VII

Appendix II.3.3-2(2) 6kV & 10kV Transformer Stations to be rehabilitated under the M/P in Yasamal

No.	Tr.station No.	Transformers			Primary Voltage (kV)	Type of Station	Num. of Panel (nos)	Circuit Breaker (nos)	Comms. Year of Tr. St	Network Area	Comms. Year of UG Cables	Priority
		Unit (nos)	Unit Cap. (kVA)	Total Cap. (kVA)								
60	508	1	400	400	6.0	KO	4	1	1966	4	1958	VII
61	292	1	320	320	6.0	KB	6	3	1969	4	1959	VIII
62	298	1	560	560	6.0	KO	4	2	1961	4	1959	IX
63	136	1	630	630	6.0	KP	4	2	1954	4	1959	IX
64	172	1	320	320	6.0	KB	4	1	1953	4	1959	IX
65	238	1	320	320	6.0	KO	4	2	1956	4	1959	IX
66	460	2	180	360	6.0	KO	6	2	1968	4	1959	IX
67	361	4	x400+2x18	1160	6.0	KB	6	0	1961	2	1959	IX
68	260	1	320	320	6.0	KB	4	2	1958	3	1960	IX
69	327	3	2x560+630	1,750	6.0	KO	8	5	1959	3	1960	IX
70	139	1	320	320	6.0	KO	4	2	1956	4	1960	IX
71	130	2	630	1260	6.0	KO	12	10	1950	9	1960	IX
72	417	1	320	320	6.0	KP	4	1	1968	9	1960	IX
73	340	3	2x320+560	1200	6.0	KO	8	5	1967	3	1960	IX
74	338	1	630	630	6.0	KO	4	1	1959	4	1960	IX
75	314	1	560	560	6.0	PMT	4	1	1956	4	1960	IX
76	324	2	1000	2000	6.0	KB	7	3	1960	4	1960	IX
77	498	2	400	800	6.0	KO	6	2	1967	3	1960	IX
78	341	3	2x320+750	1390	6.0	KB	7	6	1962	17	1960	IX
79	351	4	320	1,280	6.0	KO	14	8	1961	3	1960	IX
Total		**120**		**57,590**			**413**	**183**				

Appendix II.3.3-2(3) 6kV & 10kV Transformer Stations to be rehabilitated under the M/P in Nasimi

No.	Tr.station No.	Transformers Unit (nos)	Unit Cap. (kVA)	Total Cap. (kVA)	Primary Voltage (kV)	Type of Station	Num. of Panel (nos)	Circuit Breaker (nos)	Comms. Year of Tr. St	Network Area	Comms. Year of UG Cables	Priority
1	15	1	400	400	6.0	KO	3	1	1941	3	1927	I
2	44	2	320+630	950	6.0	KP	4	1	1938	2	1911	I
3	47	2	400+630	1,030	6.0	KB	4	2	1935	3	1922	I
4	48	2	320+630	950	6.0	KB	6	3	1935	3	1922	I
5	50	1	630	630	6.0	KP	4	2	1953	3	1928	I
6	58	1	630	630	10	KO	4	1	1927		1927	I
7	68	2	400+630	1030	6.0	KO	9	4	1930	6	1931	I
8	93	1	315	315	6.0	KO	4	2	1936	5	1959	I
9	175	2	400	800	6.0	KO	6	4	1952	6	1955	II
10	302	2	400+630	1030	6.0	KO	6	2	1963	6	1955	II
11	45	1	630	630	6.0	KP	4	4	1950	5	1911	II
12	81	2	400+320	720	6.0	KB	6	3	1952	5	1912	II
13	214	1	320	320	6.0	KO	4	1	1947	5	1913	II
14	71	1	400	400	6.0	KB	5	2	1961	5	1920	II
15	64	4	2x630+400	1660	6.0	KO	19	12	1970	5	1923	II
16	65	1	400	400	6.0	KO	6	2	1961	5	1923	II
17	75	2	320+630	950	6.0	KP	6	4	1928	5	1923	II
18	67	2	400	800	6.0	KB	12	6	1928	6	1926	II
19	51	2	400+630	1030	6.0	KP	4	2	1960	3	1931	III
20	87	1	630	630	6.0	KO	4	2	1933	6	1931	III
21	89	2	630	1260	6.0	KO	8	6	1960	6	1931	III
22	526	1	630	630	6.0	KB	3	0	1930	6	1931	III
23	326	1	320	320	6.0	KO	5	3	1959	5	1949	III
24	170	1	320	320	6.0	KO	4	1	1949	6	1950	IV
25	226	1	320	320	6.0	KB	3	0	1939	6	1950	IV
26	231	2	560	1120	6.0	KO	6	2	1964	6	1950	IV
27	256	1	400	400	6.0	KO	4	1	1966	6	1950	IV
28	79	1	630	630	6.0	KB	4	1	1940	5	1951	IV
29	173	1	630	630	6.0	KO	4	3	1949	5	1951	IV
30	225	1	400	400	6.0	KP	4	2	1938	5	1951	IV
31	138	1	630	630	6.0	KO	4	3	1958	5	1953	IV
32	86	1	400	400	6.0	KO	10	4	1964	6	1954	V
33	155	1	630	630	6.0	KO	4	2	1954	5	1954	V
34	156	1	320	320	6.0	KP	4	1	1954	5	1954	V
35	180	1	320	320	6.0	KO	4	1	1958	5	1954	V
36	310	1	320	320	6.0	KO	4	2	1959	5	1954	V
37	177	1	320	320	6.0	KO	4	1	1957	6	1955	VI
38	189	1	630	630	6.0	PMT	1	0	1956	4	1955	VI
39	197	1	560	560	6.0	KO	4	0	1957	9	1955	VI
40	221	2	630	1260	6.0	KP	6	5	1956	9	1955	VI
41	232	2	630+560	1190	6.0	KO	5	3	1960	9	1955	VI
42	233	2	320	640	6.0	KO	5	3	1960	9	1955	VI
43	240	2	320	640	6.0	KO	6	3	1944	5	1956	VI
44	265	1	630	630	6.0	KB	4	2	1965	5	1956	VI
45	154	1	630	630	6.0	KO	6	4	1959	5	1957	VII
46	158	1	630	630	6.0	KO	4	1	1948	5	1957	VII
47	176	1	320	320	6.0	KP	5	1	1958	6	1957	VII
48	271	1	630	630	6.0	KO	6	4	1948	5	1957	VII
49	178	1	320	320	6.0	KB	4	1	1958	6	1958	VIII
50	183	1	630	630	6.0	KO	4	2	1957	9	1958	VIII
51	188	2	320+630	950	6.0	KO	5	3	1960	9	1958	VIII
52	426	1	320	320	6.0	KO	7	3	1963	5	1958	VIII
53	463	1	630	630	6.0	KO	4	1	1968	4	1958	VIII
54	492	2	630+320	950	6.0	KO	9	3	1967	5	1958	VIII
55	217	2	320	640	6.0	KB	7	6	1960	5	1959	IX
56	313	1	320	320	6.0	KO	4	2	1962	9	1959	IX
57	532	1	320	320	6.0	KO	4	1	1964	5	1959	IX
58	151	1	320+400	720	6.0	KO	5	4	1955	9	1960	X
59	199	2	100+320	420	6.0	KO	6	2	1963	9	1960	X

Appendix II.3.3-2(3) 6kV & 10kV Transformer Stations to be rehabilitated under the M/P in Nasimi

No.	Tr.station No.	Transformers			Primary Voltage (kV)	Type of Station	Num. of Panel (nos)	Circuit Breaker (nos)	Comms. Year of Tr. St	Network Area	Comms. Year of UG Cables	Priority
		Unit (nos)	Unit Cap. (kVA)	Total Cap. (kVA)								
60	203	2	320	640	6.0	KP	8	5	1960	9	1960	X
61	323	1	400	400	6.0	KO	4	1	1960	6	1960	X
62	334	2	400+630	1,030	6.0	KO	4	1	1960	5	1960	X
63	336	1	630	630	6.0	KO	5	2	1962	9	1960	X
64	345	2	20	40	6.0	KO	13	8	1960	5	1960	X
65	380	2	320	640	6.0	KO	6	2	1962	9	1960	X
66	381	2	630	1,260	6.0	KO	6	2	1960	9	1960	X
67	470	1	630	630	6.0	KO	4	1	1964	9	1960	X
68	478	1	320	320	6.0	KP	4	3	1950	6	1960	X
69	522	1	320	320	6.0	KO	4	1	1967	6	1960	X
Total		**97**		**44,165**			**368**	**173**				

Appendix II.3.3-2(4) 6kV & 10kV Transformer Stations to be rehabilitated under the M/P in Narimanov

No.	Tr.station No.	Transformers			Primary Voltage (kV)	Type of Station	Num. of Panel (nos)	Circuit Breaker (nos)	Comms. Year of Tr. St	Network Area	Comms. Year of UG Cables	Priority
		Unit (nos)	Unit Cap. (kVA)	Total Cap. (kVA)								
1	211	1	400	400	6.0	KO	4	3	1960	6	1953	II
2	212	1	320	320	6.0	KO	4	2	1960			II
3	70	1	630	630	6.0	KO	5	2	1925	7	1926	II
4	91	2	400+630	1030	6.0	KO	9	5	1927	7	1926	II
5	127	2	180+320	500	6.0	KO	7	2	1940	7	1940	III
6	572	2	400+630	1030	6.0	KO	6	3	1967	7	1941	III
7	363	1	400	400	6.0	KO	4	2	1963	6	1949	III
8	163	1	630	630	6.0	KB	4	3	1956	7	1950	IV
9	165	1	400	400	6.0	KP	4	2	1940	7	1950	IV
10	166	1	320	320	6.0	KO	4	1	1950	7	1950	IV
11	406	2	320+630	950	6.0	KO	6	2	1962	7	1950	IV
12	182	2	320	640	6.0	KP	6	2	1960	6	1950	IV
13	488	1	400	400	6.0	KO	5	2	1965	9	1954	V
14	205	2	400+630	1,030	6.0	KO	6	2	1952	7	1954	V
15	308	2	180+630	810	6.0	KO	4	1	1960	7	1954	V
16	168	1	630	630	6.0	KP	4	2	1949	7	1955	V
17	185	1	320	320	6.0	KO	4	3	1957	9	1955	V
18	202	2	630	1260	6.0	KO	17	10	1945	7	1955	VI
19	268	1	400	400	6.0	KO	4	1	1950	6	1956	VI
20	458	1	320	320	6.0	KO	5	2	1967	6	1956	VI
21	503	1	320	320	6.0	PMT	4	1	1966	7	1956	VI
22	140	1	320	320	6.0	KP	4	2	1960	6	1957	VII
23	317	1	630	630	6.0	KO	4	1	1960	6	1957	VII
24	194	1	630	630	6.0	KO	4	2	1960	6	1957	VII
25	343	1	630	630	6.0	KO	4	2	1961	6	1957	VII
26	152	1	630	630	6.0	PMT	3	0	1958	7	1958	VII
27	186	1	320	320	6.0	KO	4	2	1959	6	1958	VII
28	187	1	630	630	6.0	KO	4	2	1959	6	1958	VIII
29	254	2	560	1,120	6.0	KO	6	3	1964	6	1958	VIII
30	190	1	320	320	6.0	KO	3	1	1957	6	1958	VIII
31	374	1	320	320	6.0	KO	4	2	1961	6	1958	VIII
32	278	1	315	315	10.0	KB	4	2	1959	7	1958	VIII
33	318	1	315	315	10.0	KB	3	0	1960	7	1958	VIII
34	377	2	315+400	715	10.0	KO	6	2	1959	7	1958	VIII
35	294	1	630	630	10.0	KB	4	2	1958	7	1958	VIII
36	319	2	250	500	10.0	KO	6	2	1958	7	1958	VIII
37	160	2	400	800	6.0	KB	5	1	1960	6	1959	IX
38	316	1	320	320	6.0	KO	4	2	1960	6	1959	IX
39	282	2	400+630	1030	6.0	KO	6	3	1950	7	1959	IX
40	387	2	400+630	1030	6.0	KO	7	2	1960	7	1959	IX
41	63	1	320	320	6.0	KO	4	2	1960	7	1960	X
42	133	1	630	630	6.0	KO	4	2	1958	7	1960	X
43	402	2	320	640	6.0	KO	7	2	1964	7	1960	X
44	287	1	630	630	6.0	KO	4	2	1946	7	1960	X
45	213	1	560	560	6.0	KO	4	1	1956	6	1960	X
46	280	2	400+630	1030	6.0	KO	6	4	1940	7	1960	X
47	281	1	400	400	6.0	KO	1	1	1953	7	1960	X
48	284	1	630	630	6.0	KP	3	0	1943	7	1960	X
49	356	1	400	400	6.0	PMT	4	2	1962	7	1960	X
50	403	2	630	1260	10.0	KO	6	2	1967	7	1960	X
51	456	2	400	800	10.0	KO	4	1	1951	7	1960	X
52	404	2	400+630	1,030	10.0	KO	6	2	1964	7	1960	X
53	286	2	630+400	1,030	10.0	KO	7	2	1954	7	1960	X
54	339	2	400+630	1030	10.0	KO	6	1	1959	7	1960	X
Total		**75**		**34,335**			**267**	**110**				

Appendix II.3.3-2(5) 6kV & 10kV Transformer Stations to be rehabilitated under the M/P in Khatai

No.	Tr.station No.	Transformers			Primary Voltage	Type of Station	Num. of Panel	Circuit Breaker	Comms. Year of Tr. St	Network Area	Comms. Year of UG Cables	Priority
		Unit (nos)	Unit Cap. (kVA)	Total Cap. (kVA)	(kV)		(nos)	(nos)				
1	20	1	400	400	10.0	KO	7	4	1950	8	1948	III
2	21	1	400	400	10.0	KO	6	3	1950	8	1948	III
3	31	1	400	400	10.0	KO	5	3	1962	8	1953	IV
4	32	2	400	800	10.0	KO	6	2	1958	8	1953	IV
5	33	2	630	1,260	10.0	KO	6	1	1958	8	1953	IV
6	29	2	630	1,260	10.0	KO	8	5	1953	8	1955	VI
7	35	1	320	320	10.0	KO	6	3	1963	8	1957	VII
8	27	1	400	400	10.0	KO	4	2	1958	8	1958	VIII
9	41	1	630	630	10.0	KO	4	2	1956	8	1958	VIII
10	36	1	400	400	10.0	KO	6	3	1958	8	1958	VIII
Total		**13**		**6,270**			**58**	**28**				

Appendix II.3.4-1 Transformers to be replaced

Transformers		Sabail	Yasamal	Nasimi	Narimanov	Nizami	Khatai	Total
20 - 400 kVA	Unit (nos)	43	65	56	45	8	0	217
	Capacity (kVA)	15,455	22,020	18,615	15,645	3,120	0	74,855
560 - 630 kVA	Unit (nos)	26	49	41	30	5	0	151
	Capacity (kVA)	16,240	29,820	25,550	18,690	3,150	0	93,450
750 - 1000 kVA	Unit (nos)	0	6	0	0	0	0	6
	Capacity (kVA)	0	5,750	0	0	0	0	5,750
Total	Unit (nos)	69	120	97	75	13	0	374
	Capacity (kVA)	31,695	57,590	44,165	34,335	6,270	0	174,055

CHAPTER 4

FACILITY PLAN
FOR FORMULATING THE MASTER PLAN

CHAPTER 4 FACILITY PLAN FOR FROMULATING THE MASTER PLAN

4.1 General

In this Chapter, the basic approach for the plan of distribution network facilities in view of accommodating the future increase of energy demand and improving the supply reliability is explained, in order to present the future picture of distribution network. The basic approach explained here is also the basis for deriving the size of the rehabilitation project scale. Major items are explained as follows:

4.2 System Voltage Augmentation from 6 kV to 10 kV

Provided that the system voltage augmentation from 6 kV to 10 kV, more than 2.5 times of current carrying capacity can be obtained with the same cable size. Since the Study area encompasses the central area of Baku City with higher demand density, the system voltage augmentation to 10 kV in the near future will benefit the said area. In the Master Plan Study, however, the voltage augmentation from 6 kV to 10 kV is not taken into account except for MV distribution line stated later, due to the following reason:

(a) The scope of the Study agreed between two countries in the preliminary study (in March 1999) is for MV distribution facilities with 6 kV and 10 kV, and the LV distribution facilities served for power supply to customer both of which are owned and operated by BEN.

(b) In the case of the voltage augmentation from 6 kV to 10 kV, it is premised that the 110/10-6 kV and 35/10-6 kV transformers in Azenerji's substations have to be replaced or newly construction of substations is required (not included in the scope of the Study).

When it comes to implementing the Master Plan, and recognizing the necessity of converting a part of 6 kV system in the Study area to 10 kV system, it is considered as appropriate that in the "Detailed Design stage" (undertaken in the initial stage of the project implementation) additionally examine the replacement plan for 110/10-6 and 35/10-6 kV substations, and incorporate the plan.

4.3 Medium Voltage Underground Lines

In the present distribution network, there are many single-circuit lines for 6 kV system. For the 10 kV system adopted since 1965, however, the establishment of the system with double-circuit line is being promoted. Therefore, the 10 kV system has been presenting a more reliable supply than the 6 kV has done.

In fact, the rehabilitation plan for the central Baku City formulated in 1989 (see Section 1.2 in Volume II) foresees the upgrading of system voltage from 6 kV to 10 kV, and double-circuit line for newly laid 10 kV line. Generally, underground distribution system has been adopted in the urban area where the demand is very high. For the system structure, three-circuit called "spot network system" and double-circuit called "main line-spare line system" has been adopted. Accordingly, in principle, most of the underground lines to be rehabilitated are changed to double-circuit lines.

Most of the underground lines for rehabilitation are 6 kV lines. The necessity of voltage upgrade in accommodating the demand increase will be possibly realized. In this case, if the cables are replaced afresh, the laying works might trouble the neighboring residents and transportation, and bring about big additional cost. As the price difference between 6 kV and 10 kV cable is small, and laying works cost between them is almost the same, underground cable with rated voltage of 10 kV is adopted for newly laid cable.

4.4 Medium Voltage Switchgears

In the present MV distribution system, all lines are directly connected into the transformer stations. To minimize the cost, however, the usage of expensive circuit breaker for line protection has been limited and installed at the sending side of line with the cheap disconnecting switch installed at receiving side. Then, the Study Team suggested that rather than the method currently applied by BEN, the main line-spare line system which requires relatively cheaper construction cost be adopted in the future. This system lays the main line with double-circuit, T-branched line from the double-circuit line to each transformer station, and supplies the power through the cheap load break switch. However, BEN has experienced accidents caused by the trouble at the cable joint point, and is not supportive for the adoption of T-branch at this time.

As explained in Chapter 5 in Volume 1, the number of accident in MV facilities causing outage has increased from 4.7 cases/day in 1994 to 9.4 cases/day in 1998. Among this, the accident in underground cable has accounted for high portion of 65 - 84 %, enhancing BEN's anxiety.

Accordingly, the currently adopted system configuration is followed in the Master Plan. The system configuration is designed to ensure easy system switching and inclusion of automatic dispatching system in the near future, while minimizing the project cost. The basic system configuration is presented in Figure II.4.4-1. The circuit breaker for fault detection and cut-off the fault section from the system will be installed at the sending end of the line, and a remote-controlled load break switch which functions to cut the load current is adopted at the receiving end. In case that the space for installation of the circuit breaker is not available in the transformer station building, however, it is considered that the load break switch is adopted on the line drawn into the station, and that the circuit breaker is installed in the station at the other end of the line for line protection.

For the primary side of the transformer circuit, though the disconnecting switch with power fuse is currently adopted, the load break switch with power fuse which functions breaking the load current is adopted in this Master Plan.

4.5 Transformers

For the transformer, the oil-immersed transformer is considered as a standard. The molded dry type transformer is, however, adopted for the transformer station type, which stands close to other building and borrows the space from a part of other building, and for the compact type station. Transformer capacity includes 400 kVA, 630 kVA and 1,000 kVA.

4.6 Renovation of Transformer Station Building

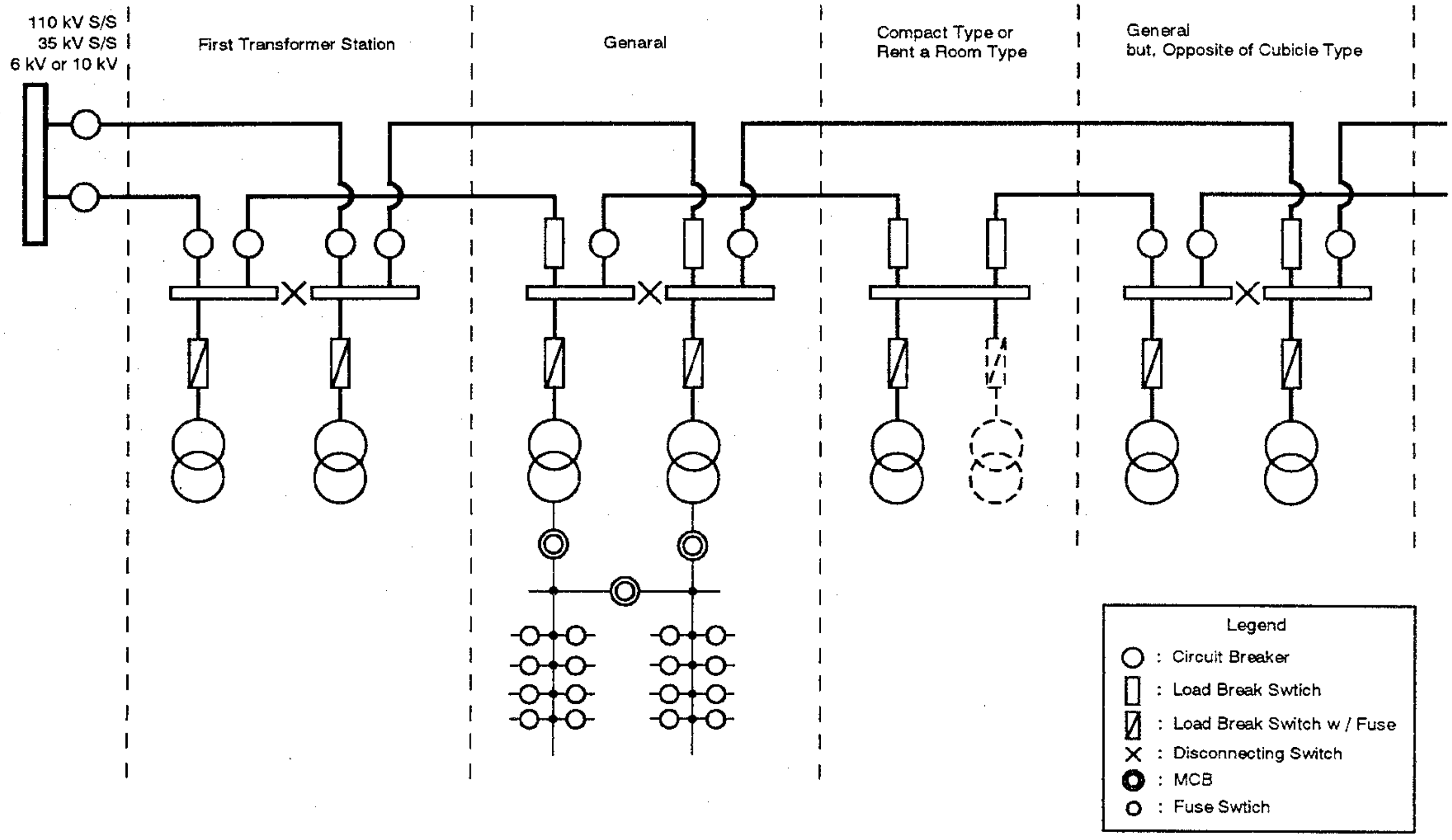
The transformer station to be rehabilitated is the one for which MV switchgear is to be rehabilitated. The existing transformer station building has been designed based on the size of bulk-oil type or minimum-oil content type circuit breaker. Especially, in the case of 6 kV transformer stations, the building is designed based on the single circuit line. Accordingly, the room is too small to install enough switchgear to establish the proposed double circuit system configuration. In addition, since the Study area is an urbanized area, it is often difficult to expand the station building, and find the alternative location except for the transformer stations in the green-belt area and the parks. Particularly, the transformer stations, which borrow a part of the space of the buildings, are rarely available for expansion.

Examination on the detailed survey result for the basic design level study discussed later indicates that there are many ground-mounted type (standing independently) transformer stations, which are available without expanding the building, if the partitioning layout for its equipment room is changed. However, the ground-mounted type transformer stations, which adjoin to other building and borrow a part of space of the building do not provide enough space for installing the switchgears. For these kinds of transformer stations, adjustments including pulling only one line into the station are needed at the stage of detail design.

There are still some transformer stations which can not prepare the space for necessary number of switching equipment, even though they exists at the important location in the system configuration. In this case, the new construction or expansion of the existing transformer station building is suggested, if enough neighboring space is available. Unless it is available, however, it is necessary to change the system configuration, and lessen the importance of the concerned transformer station for the system. In this Master Plan Study, the ratio of each transformer station by above-mentioned approach against the total will be estimated based on the result of basic design level study.

4.7 Low Voltage Switchgear

Under the current system, the LV distribution panel is installed for each transformer. The same system is adopted in the Master Plan. The average number of feeders to be drawn from one low voltage panel is supposed to be as 8 lines, and 6 lines for ground-mounted compact type transformer station. It is also noted that in many transformer stations, there are plural feeders connected with one switchgear. To improve this situation, it is considered as valid that low voltage and small switch panel be installed on the way of low voltage lines.



Master Plan Study on Rehabilitation and Reconstruction of Electric Supply in Baku Изучение Генерального Плана Восстановления И Реконструкции Электроснабжения Города Баку	Figure / Рисунок No. II.4.4-1
Baku Electric Network ПО "БАКЭЛЕКТРОСЕТЬ" / Japan International Cooperation Agency Японское Агентство Международного Сотрудничества	Title / Название Рисунка
Joint Venture Nippon Koei Co., Ltd. & KRI International Corp. Совместное предприятие НИППОН КОЕИ и KRI Интернешнл Корп.	Basic System Configuration

CHAPTER 5

MASTER PLAN

Chapter 5 MASTER PLAN

5.1 General

This chapter is aimed to identify substance of rehabilitation and reconstruction for the existing facilities, based on the fundamental policy for the facility plan, which was discussed in Chapter 3 of Volume II and explained in a detail plan of implementation of the rehabilitation and reconstruction in the next ten years.

5.2 Facilities and Materials to be Procured

5.2.1 Materials for MV Underground Cables

As indicated in Table II.3.2-3, the total number of lines is 485, against the number of sections of underground distribution lines to be rehabilitated of 469. Namely, the ratio of dual circuit system is as low as 3.4% and majority of distribution lines to be rehabilitated is of single line system configuration. The ratio of the dual circuit system configuration is much smaller than that shown in Table II.3.2-3, however, it is natural as in fact the old distribution system was basically configured as the single line system. As explained in Chapter 4 of Volume II, in order to improve the reliability of electricity supply of 6 kV up to and above that of the existing 10 kV system, we plan, as a basic principle, the rehabilitation scheme of the underground cables within the rehabilitation area to constitute as the double circuit configuration. To meet with this requirement, it is necessary to procure cable length of 493.6 km.

Cables to be procured will be 6/10(12) kV cross linked polyethylene insulated (XLPE) vinyl sheathed cables of aluminum conductor of 3x240 mm^2 and 3x150 mm^2. The former will be used for the lines constituting main and the loop system and the latter will be used to branch lines. Furthermore, to specify size/scope of procurement, we assumed the ratio of procurement of the two kinds as 70% and 30%. Regarding the length per one drum, we decided 400 m for the former and 500 m for the latter in considerations of inland transportation route from Georgia and of cable-laying works in congested road condition in the city. Concrete plates will be applied for the protection of the laid cable instead of bricks, which is applied to identify the cable laid point. To reduce the project cost, steel tape-armored cables will not be applied.

As cable accessories, joint kit for straight connection and terminal kit for connection between cable and switchgear are necessary. For the former terminal, 120% of total quantity of cable drums, and for latter, the same number as the number of the switchgears of the distribution lines are required.

5.2.2 Medium Voltage Switchgears

As MV switchgears, we plan to use the following switchgear panels. For switchgears for distribution lines and for bus tie circuits, motor driven types will be applied, in consideration of future application of auto-dispatching system (refer to Chapter 6 of this volume). Measuring transformers will be applied to the outgoing feeders and transformer circuits.

(a) Outgoing feeders: SF6 gas or vacuum circuit breakers (600A rating)
(b) Incoming feeders: SF6 Load Break Switches (LBS, 600A rating)
(c) Bus-tie: SF6 LBS (2000A rating)
(d) PT circuits: PT (Potential Transformer) and Voltmeters
(e) Transformer circuits: SF6 LBS and Power Fuses

As a basic principle, double-circuits will connect to each of transformer stations, however, the existing transformer stations are very narrow in space and it is difficult to install switchgear panels responding to the two circuits configuration. Namely, we explained in Chapter 5 of Volume 1 that the transformer stations are classified into three types, however, based on constructions of buildings, they are divided into four types i.e.:

(i) Ground-mounted building type standing independently
(ii) Ground-mounted building type close to the other buildings
(iii) Rented rooms in building
(iv) Compact type

In many of types of not only above (iv), but also of (iii), there insufficient spaces to install switchgear panels which will be required for dual circuits and even in the case of part of type (ii), since they were designed to install in a tight space, it is difficult to install required panels. Accordingly, in the Master Plan, single circuit of the dual circuits will be connected for these stations. The transformer stations to which single line will be planned to be connected are as shown in Table II.5.2-1.

Table II.5.2-1 Number of transformer stations to which single-line will be connected

Type of buildings	No. to be rehabilitated	Assumed Percentage	Single-line connection
Near to adjacent buildings	26	30%	8
Rented room type	57	70%	40
Compact type	13	100%	13
Total	96		61

Based on the above, the number of switchgear cubicles to be rehabilitated are as shown in Table II.5.2-2. As explained later, although it is required to increase transformer capacity to meet the increasing demand, in our plan, the number of transformers remain unchanged and unit capacities will be increased.

Table II.5.2-2 Switchgear panels to be installed

Kinds	No. of Boards
Circuit Breaker panel	877
LBS panel	877
Bus Tie panel	201
PT panel	402
Transformer circuit panel	374

In above quantity, 26 sets of switchgear panel and 13 sets of transformer circuit panel will be installed in the compact type transformer station.

5.2.3 Transformers

The details about transformers to be rehabilitated are shown in the Table II.5.2-3. It is not intended to renew the existing transformers of the same capacities, but we plan to select capacities of transformers to be procured in consideration of increase in power demand from three kinds of 1000kVA, 630kVA and 400kVA. As for number of transformers, which will be installed at a transformer station there will be one for Compact type and two for other types of transformer stations.

Table II.5.2-3 Details about transformers to be rehabilitated

Capacity (kVA)	Sabail	Yasamal	Nasimi	Narimanov	Nizami	Total
1000		5				5
750		1				1
630	22	34	37	27	5	125
560	2	15	4	3		24
400	23	24	19	21	7	94
320	19	35	33	17	1	105
315	1		1	3		5
250	2	2		2		6
180		4		2		6
100			1			1
20			2			2
Total	69	120	97	76	13	374
(MVA)	31.1	57.6	44.2	34.3	6.3	173.4

From the result of power demand forecast, which is discussed in Chapter 7 of this Volume, the peak power and demand increasing rate in 1999 and 2010 are calculated as shown in Table II.5.2-4. In the table, the reason why demand increasing rate at Sabail and Yasamal are substantially lower than that of other areas is because of larger consumption per person and based on the assumption that some effects of demand control will be realized by normalization of electricity business. Although the demand increase ratio in the overall Study area is 15.7%, since there is no target transformer station in Khatai, the demand increase ratio of the area except Khatai is 16.8%.

Table II.5.2-6 Numbers and capacities of transformers to be installed under the Master Plan

		1000 kVA (set)	630 kVA (set)	400 kVA (set)	Total (MVA)
i)	Capacities of transformers to be rehabilitated shown in Table III.5.2-3 are unified to 3 kinds	6	149	219	187.5
ii)	Transformers to be procured under the Master Plan (in consideration with utilization factor)	36	196	142	216.3

In 262 transformer stations to be rehabilitated, there are 26 "Close to another building" type, 57 "Rented room" type, and 13 "Compact" type. The number of transformers is 120 and total capacity of them is 59.7 MVA. For these transformer stations, molded dry type transformers will be installed to protect neighborhood from fire and poisonous gas. The molded dry type transformers to be procured are shown in the following table.

Table II.5.2-7 Dry type transformers to be procured

Unit Capacity	Set	Total Capacity
1000 kVA	10	10.0 MVA
630 kVA	66	41.6 MVA
400 kVA	53	21.2 MVA
Total	129	72.8 MVA

In transformers shown in Table II.5.2-7, 9 sets of 630 kVA and 4 sets of 400 kVA transformers will be installed in compact type transformer stations with MV switchgears and LV distribution panels.

Accordingly, the oil type transformers to be procured are shown in Table II.5.2-8.

Table II.5.2-8 Oil type transformers to be procured

Unit Capacity	Set	Total Capacity
1000 kVA	26	26.0 MVA
630 kVA	130	81.9 MVA
400 kVA	89	35.6 MVA
Total	245	145.3 MVA

5.2.4 Low Voltage Distribution Panels and Low Voltage Line Materials

For the secondary side of each transformer, one LV distribution panel will be installed. The number of feeders to be installed at one LV panel will be 6 feeders for compact type transformer stations and 8 feeders for other transformer stations. Since it will be necessary to increase transformer capacity depending upon demand increase, the current carrying capacity of secondary side of transformer circuits will be selected to meet with capacities of 1000 kVA transformers. For compact type stations, the current carrying capacity will be decided according to the transformer to be installed.

Since the number of transformers installed in transformer stations are standardized to be two sets, except for compact type stations, it will be standardized to install two LV panels. To avoid power failures during transformer faults, bus tie switches will be installed to mutually connect two LV panels. The current carrying capacities of LV panels are shown in the following table.

Table II.5.2-9 Current carrying capacity of LV panel

	Main circuit	Bus tie	Feeder circuit
Transformer stations other than compact type	1,800 A	1,800 A	4 x 400 A + 4 x 250 A
Compact type (630 kVA Transformer)	1,200 A	-	2 x 400 A + 4 x 250 A
Compact type (400 kVA Transformer)	800 A	-	6 x 250 A

Concerning power cables of LV distribution lines, 0.6/1 kV "cross linked polyethylene insulated (XLPE) vinyl sheathed steel tape armored cable of aluminum conductor" will be applied to underground cable lines. Azerbaijan's standards for the power cable installation specify to install bricks or blocks only for identification of the cable laid points and not for protection of cables. Since a large number of LV cables will be installed, it is difficult to install the concrete plate for protection at the same manner of the MV cables. Accordingly, steel tape armored cables will be applied to protect the cables from cutting.

As for cable sizes, two kinds of $3\times240+1\times95$ mm^2 for main circuits and $3\times150+1\times70$mm^2 for other circuits for underground lines, and $3\times150+1\times70$ mm^2 for main lines and $3\times70+1\times70$ mm^2 for other circuits for house flank lines will be applied.

5.3 Rehabilitation and Reconstruction Plan of Distribution Network

The underground cables to be rehabilitated of each district are shown in Appendixes II.3.2-2 (1) to (6) in Chapter 3, and the transformer stations are shown in Appendixes II.3.3-2 (1) to (5). The priority order of the facilities to be rehabilitated, as already explained, is basically judged by the laying year of the underground cables. On the other hand, the cable length by the laying year presented in Table II.3.3-2 differs largely among the district in the Study area. Provided that the Master Plan over 10 years for each administrative district is independently formulated under such situation as above, the extent of overage of the targeted facilities for rehabilitation might differ from district to district. For example, the cables laid before early 1920's will be replaced in the initial year of implementation in Sabail, however, those before 1950 will be done in Narimanov district.

To formulate the Master Plan covering the entire Study area by avoiding such contradiction, the Master Plan will be worked out so as to achieve its equality over the entire Study area and over 10 years. Then, the Master Plan will be conveniently divided into each Study area district. This will not only make it possible to provide the funds to be invested will be directed, with more priority, to more superannuated facilities, but also will contribute to effects that the consistency between the Master Plan and the plan targeted for particular narrow area including basic study will be easily recognized. Further, years of rehabilitation implementation of objective facilities are allocated based on numbers of transformer stations. Length of MV underground cables and number of switchgears and number/capacity of transformers are counted to meet the actual status of allocated transformer stations and underground cables.

Table II.5.3-1 shows yearly plan for facilities to be rehabilitated in the coming ten years, which were studied based on the above criteria. Furthermore, implementation years of rehabilitation per administrative districts are indicated with respect to the implementation years shown in the Appendixes II.3.2-1(1) to (6) and II.3.3-2 (1) to (5) in Chapter 3 of this Volume.

Table II.5.3-1 Yearly rehabilitation plan

Year	Underground Cable		Transformer station		
	No. of lines	Length of lines	No. of station	No. of transformer	Transformer capacity
1	51	23.4 km	27	42	20.8 MVA
2	52	23.0 km	27	40	19.1 MVA
3	50	23.8 km	26	37	16.9 MVA
4	46	22.9 km	26	36	17.5 MVA
5	57	23.2 km	26	34	15.8 MVA
6	49	23.6 km	26	36	17.5 MVA
7	41	23.4 km	26	32	15.1 MVA
8	46	22.8 km	26	31	13.1 MVA
9	31	22.8 km	26	46	20.3 MVA
10	46	24.1 km	26	40	17.4 MVA
Total	469	232.9 km	262	374	173.4 MVA

CHAPTER 6

LOAD DISPATCHING SYSTEM

Chapter 6 LOAD DISPATCHING SYSTEM

6.1 General

As described in Chapter 1 of Volume I, the objective facility of this Study was the 10 kV and 6 kV distribution system, which were managed by BEN as of March 1999. However, due to the re-organization of BEN, in addition to the system, the objective has been expanded to the 35 kV distribution system, which had been managed by Azenerji. Under such situation, the existing load-dispatching system is required to cover the whole distribution system including 35 kV, 10 kV and 6 kV.

In order to establish a reliable system, a new load dispatching system covering the whole distribution system has to be planned based on the rehabilitation and reconstruction plan. In this Chapter, an automatic load dispatching system, which is recommended for the whole distribution system in Baku, is described.

6.2 System Configuration of the Central Load Dispatching Center

The existing central load dispatching center (CLDC) consists of only a large supervisory and control board and the system have not been functioned due to its deterioration. Therefore, the new system is recommended to establish and achieve a reliable system, while all existing ones are removed. The basic conception of the new CLDC is (1) an automatic distribution dispatching system, which cover the 35 kV substation equipment as well as the 10 kV & 6 kV distribution facilities, (2) use of a computer to constantly supervise status of the equipment and (3) a function of automatic restoration.

The recommended system is composed of (a) distribution network supervisory control unit, (b) Substation supervisory control unit, (c) dispatcher terminal and (d) display panel.

(a) Distribution network supervisory control unit makes a continuous monitoring of the transformer station composing the distribution network. When a line fault occurs in a section, the unit detects the fault and automatically disconnects the section so as to ensure the continuous power supply to the unaffected sections of the network.

(b) Substation supervisory control unit makes a continuous monitoring of the substation such as remote control, voltage and current monitor, etc. In case of a fault, an automatic restoration can be achieved in accordance with a predetermined program.

Monitoring of the network by the above units is aiming to save a time for restoration and realize a much reduction of power outage period.

(c) Dispatching terminal is a man-machine interface between the automatic distribution dispatching system and an operator. The terminal displays operation and status of the equipment as well as measuring values such as voltage and current.

(d) Display panel is composed of three large screens; each for display of distribution network, substations and both. In case of a fault, an automatic indication is available to show the fault location and the indication can be changed by an order of operator.

The automatic load-dispatching system is established flexible enough in view of accommodating the integration, when the change in network is required architecture in the future. Therefore, the Local Area Network (LAN) system is built from the points of view of hardware and software.

The recommended system configuration of the automatic load-dispatching system of BEN is shown in Figure II.6.2-1. The outline of main devices of the automatic load-dispatching system is as follows.

(a) Distribution network supervisory control unit (main unit)

- Computing system comprising of central processing unit, magnetic disk device, controller and other equipment
- Automatic supervision and control of MV switchgears at the transformer stations
- Automatic current and voltage metering in distribution line
- Automatic fault detection in a line and rerouting of distribution line
- Automatic evasion of overload operation
- Automatic operation for planned works
- Automatic recording (accident record, network operation, measuring record, etc.)

(b) Distribution network supervisory control unit (backup unit)

This system automatically takes over processing in the event that the main distribution network supervisory control unit goes out of service.

(c) Dispatcher terminal

- Display distribution line system diagram with overlay to road maps, distribution network diagram, and single line diagram of the transformer station
- Display value of automatic metering
- Display single line diagrams of Azenerji's substation including SV (Supervision)/TM (Telemeter) information
- Remote control of MV switchgears at the transformer stations and feeder CBs at Azenerji's substations

- Maintenance of map, distribution networks diagram, single line diagram and etc.
- Setting of system clock

(d) Large size screen type display

The large size screen will be required to ensure that the same contents displayed in each dispatcher terminal are monitored for information sharing purpose. When a fault occurs on transformer station or distribution line, the screen will automatically show the required information such as system diagram of the fault point.

(e) Distribution network diagram display panel

- Display of single line diagram of the distribution system
- Display of main distribution lines on an electrical map
- Display of remote measured value of a line

(f) Radio communication control equipment

- Supervising and control of transformer stations (through radio communication equipment)
- Automatic supervise radio communication equipment and communication line

(g) Substation supervisory control unit (master station)

- Supervising of bus bars and switchgears at substation
- Remote controls for switchgears at substation by command form the dispatcher terminal
- Remote measurement of voltage and current in feeders
- Automatic supervising communication lines

(h) Substation SV (supervision)/TM (telemeter) display panel

- Display of SV/TM information for substations
- Display of single line diagram of substations

(i) Training terminal

- Simulation of distribution line operation
- Simulation of automatic reroutes power distribution

(j) Office terminal

- Database keeping of equipment management records
- Provision of operation order for distribution network works

6.3 Facilities in the Transformer Station

The transformer stations, which play the important role in the network, will be equipped with remote controlled MV cubicles operated from CLDC. Although the number of cubicles under the remote control will depend on the size and position of the transformer station in the network, the system is established so as to operate remotely all transformer stations.

The remote control is made through microwave network with 400 MHz band UHF. Radio antenna is installed on the transformer stations or the taller neighboring buildings.

The remote controlled cubicles are equipped with detectors for status change. Each motorized cubicle is connected to the Remote Terminal Unit (RTU) to ensure the remote control from CLDC.

The outline of the RTU is as follows:

(a) Connecting the motorized cubicle to the radio system, and having the capacity to control more than four motorized cubicles and fault detectors

(b) Comprising of a 220 V isolating transformer, DC power supplies with backup batteries, a control panel, a remote control card standardized type, a fault detector card, a radio transceiver and so on

(c) Connecting to the power source in parallel to the transformer station control power supply circuit downstream of the MCCB (Molded Case Circuit Breaker) located on the LV panel or MV cubicle

(d) Using the radio system only for data communication requirements of CLDC

(e) Allocating the frequency of 400 MHz band UHF for radio communication system

The motorization of equipment is required to conduct remote control for the MV switchgears in the transformer stations.

In the early stage of the Master Plan implementation, it is anticipated that the automatic load-dispatching system will not be established yet. In view of this, motorization of equipment to be installed in the early stage will be required to smoothly realize the remote controlling from CLDC.

6.4 Facilities in 35 kV Substation

In order to make remote supervision and control to the 35 kV substation, which is newly managed by BEN, sub-supervisory and control unit will be installed in the substation. The sub-unit makes data exchange between the main units in CLDC, and send an operation signal corresponding to a command from the center. Vice-via, status of substation equipment sends to the main unit through the sub-unit. Data for the existing 35 kV substation has not been available because it was not included in this Study, but this recommendation is made subject to the following conditions.

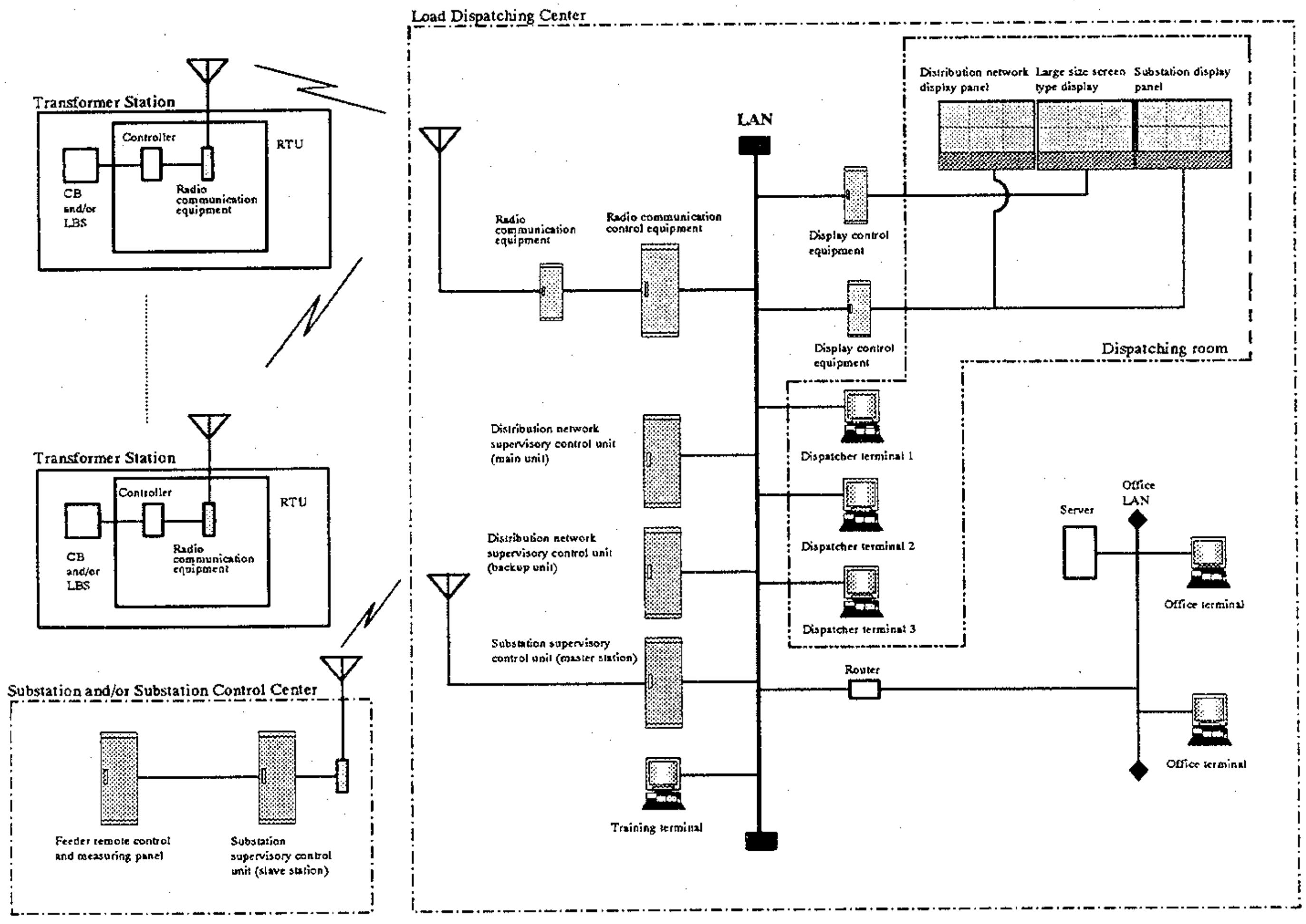
(a) Equipment is motorized.

(b) Equipment has a function of receipt of remote signal.

(c) Equipment has a function to send its status to the sub-unit.

(d) Equipment has a function to send its status to the sub-unit by exchange of measuring data from analog (4-20 mA) to digital.

In future, data communication between the 35 kV substations and CLDC will be established by optical fiber cable with rapid and large capacity. Taking into consideration of the existing system, two communication methods are available; one is use of the existing telephone lines and the other is by construction of radio wave paths. In this Study, the latter is recommended by the reason of more reliability and economy.



Master Plan Study on Rehabilitation and Reconstruction of Electric Supply in Baku Изучение Генерального Плана Восстановления И Реконструкции Электроснабжения Города Баку	Figure / Рисунок No. II.6.2-1
Baku Electric Network ПО "БАКЭЛЕКТРОСЕТЬ" — Japan International Cooperation Agency Японское Агентство Международного Сотрудничества	Title / Название Рисунка
Joint Venture Nippon Koei Co., Ltd. & KRI International Corp. Совместное предприятие НИППОН КОЕЙ и KRI Интернешнл Корп.	Automatic distribution dispatching system

CHAPTER 7

ENERGY DEMAND FORECAST FOR BEN'S CUSTOMER

Chapter 7 ENERGY DEMAND FORECAST FOR BEN'S CUSTOMER

7.1 Objective

Electrical energy consumption by BEN's customer is forecast by year and district until 2010. Both annual consumption in GWh and peak demand in MW are forecast. The forecast for energy power demand will provide a basic condition for power distribution system planning.

7.2 Methodology

Energy demand by BEN's customer is forecast by three categories: "residential", "industrial" and "other". The following explains the idea, methodology and assumptions for the forecast.

7.2.1 Residential Energy Demand

(1) General

Energy demand in 2010 is forecast based on the population and the energy consumption per capita projected for 2010. The population in 2010 is forecast by analyzing both natural and social changes. The population data in 1999 collected from the statistical office of Baku City, however, are to some extent questionable in reliability. The energy consumption per capita by district in 1999 was derived by dividing the total energy consumption of a district by the population in that district as shown below.

Table II.7.2-1 Energy consumption per capita in Baku in 1999

Area	Energy consumption per capita (kWh/person/year)
(Study area)	
1 Sabail	2,234
2 Yasamal	975
3 Nasimi	1,130
4 Narimanov	1,356
5 Nizami	1,091
6 Khatai	1,277
Subtotal	1,235
(Outside Study area)	1,567
Total of Baku	1,379

(Note) The values above include the portion of "Inspection" demand with a total of 12.9 GWh allocated to each district in proportion to the residential demand in each district.

The highest rate was that in Sabail at 2,234 kWh/person/year, while the lowest rate was that of Yasamal at 975 kWh/person/year with a difference of about 2.3 times.

Energy consumption rates in CIS countries are generally higher than world levels as a result of low tariff collection rate and socially set energy tariff level, often much lower than the cost. In the future this condition needs to be improved to eliminate social unfairness and economic inefficiency. An improved tariff system would give an incentive to BEN's customer to save energy consumption level, with per capita energy consumption rate approaching the world level. An analysis, therefore, needs to be made concerning the future rate of energy consumption as compared with the level of other countries in the world. This comparison could be made in terms of energy consumption per capita. Population data collected from the Baku statistical office are used for this reason. Population data are the most basic and important factor for any kind of planning. It is strongly recommended that a full-scale population census survey be conducted at the earliest possible time so that planning of various kinds could base their analysis on the population data reflecting the actual condition of an area.

(2) Alternative Scenarios

Two scenarios are set for residential energy demand forecast: "High growth scenario" and "Save-energy scenario". The both scenarios applied the same population figure for 2010. Different assumptions were applied in the energy consumption per capita. The "High growth scenario" assumes that the present tariff collection system be maintained until 2010. The per capita energy consumption rate will increase as a result of income rise. No reduction is assumed on inefficient energy use. The "Save-energy scenario", on the contrary, assumes that an improvement be made in the present energy tariff collection system resulting in promoting more efficient energy use. Energy consumption per capita will approach the world level. The impact of income rise would be surpassed by then by an improved energy tariff system. Energy demand for heating in winter, however, is a need specific to Baku and added to the normal energy demand.

(3) Assumptions

The following assumptions are applied to forecasting the residential energy demand.

(a) Electrification rate

No recent data are available in Baku concerning the number of households. It is, therefore, impossible to estimate the rate of electrification by comparing the number of residential customers and that of households by district. Since the study area, covering the central part of Baku City, is an urbanized area, the area would be almost 100% electrified. The following table shows the population, the number of residential customers and population per customer.

Table II.7.2-2 Population, number of residential customer and population per customer in 1999

Item	Study area	Outside study area	Total
Population (10^3)	1,014.1	774.5	1,788.6
Number of residential customer (10^3)	217.5	142.1	359.6
Population/customer	4.7	5.5	5.0

The number of population per customer was 4.7 in the study area. The number of household members, according to the 1989 population census, was 4.3 in 1989. Assuming this household size as still prevailing in Baku now, the number of population per customer at 4.7 is 9% higher the household size. Considering the possibility that in some cases more than one household receive energy through one contract, it would be reasonable to assume that almost all the household in the study area receive energy. Outside the study area, however, it is possible that electrification is lower than 100% and there may be room for further electrification in the future. Projection of residential energy demand outside the study area is to be made applying the same methodology as for the study area due to lack of reliable data on household and electrification rate.

On this basis, the projection of residential energy demand in Baku will be carried out assuming no change in electrification rate. Growth in demand would be affected only by the change in population and the energy consumption rate per person or customer.

(b) Population growth

The population growth rate applied to all the districts in Baku and the two scenarios is 2.1% per year. Two factors are considered: natural growth due to birth and death and social increase due to migration. The natural growth rate is set at 1.5 % per year based on the data of Azerbaijan between 1989 and 1998 as shown below.

a. Population in 1989: 7,014.2 thousand
b. Population in 1998: 7,876.7 thousand
c. Net migration between 1990 and 1998: 161.6 thousand
d. Population in 1998 without considering migration: 8,038.3 thousand
e. Natural population growth rate: 1.5 % per year

The same rate of 1.5 % per year for natural population increase could be applied to Baku. The total population in Baku, however, will increase faster because of the migration into Baku by the people seeking job opportunities. This social change of Baku population was estimated based on the ratio of growth in non-agriculture employees to that in non-agriculture GDP in Azerbaijan between 1995 and 1998.

Table 7.2-3 Increase in non-agriculture employment relative to non-agriculture GDP

Item	1995	1998	Rate of change (%/year)
Non-agriculture GDP (10^9 AZM, 1995 price level)	7,991	10,012	7.8
Non-agriculture employment (10^3)	2,500	2,617	1.5
Employment elasticity		0.19	

The total population in Baku in 2010 is forecast by natural growth and social growth as follows:

- Natural growth: 1.5% per year
- Social growth: 6.0%/year times 0.19= 1.1%/year
- Total population growth: 1.5% + 1.1% = 2.6% per year

The growth rate of non-agriculture/non-oil sector is set at 6% per year, referring to a log-term outlook by an international aid organization.

The possibility of a population decrease due to return of refugees and IDP to their home land is not considered due to the difficulty in forecasting political development with Armenia and the possibility of refugees and IDP settling in Baku.

(c) Energy consumption per capita

"High Growth Scenario"

The " high growth scenario " assumes that the present tariff collection system be maintained until 2010, with no reform. Under this situation, inefficient use of energy will continue since there is no incentive on the part of customers to restrain energy use. The present energy use at about 1,379 kWh per person per year, which is about double the ordinary consumption level of the developing countries with electrification rate of close to 100% at about 600 kWh per person per year, will increase along with a rise in income level. The following assumptions are set.

- Increase in income: 6.0 % per year (referring to long-term outlook of international organizations)
- Income elasticity: 1.0 (Income elasticity of energy use is often found in the range of 1.0 to 2.0 in the case of developing countries with growing economy.)

"Save-energy scenario"

The "save-energy scenario " assumes that the electricity tariff collection system be reformed by 2010, resulting in more efficient use of energy. After the reform, all the customers are obliged to pay the bill calculated based on the tariff level modified taking into consideration cost recovery. Per capita energy use will approach the world level. . The impact of income increase will be surpassed by that of the tariff system reform. The following per capita consumption rate is estimated as the standard rate.

- Heating demand in winter: 200 kWh/person/year
- Regular demand: 800 kWh/person/year
- Total demand: 1,000 kWh/person/year

Energy consumption for heating purpose is estimated to be 184 kWh per person per year in 1998 based on the data provided by ESE as shown in Appendix II.7.2-1. For 2010, heating demand is set at 200 kWh/person/year. Regular demand at 800 kWh/person/year is used as the world average level for urban areas in developing countries with 100% electrification. This value in urban area is estimated to be about 30% higher than the national average rate of these countries at around 600 kWh/person/year.

Residential energy use per capita in each district is estimated based on the following assumptions. In the event that the per capita consumption level in 1999 is higher than 1,000 kWh/person/year, the consumption rate will keep declining at 2.9% per year until 2010. The rate 2.9% per year is the annual average rate of change from 1,379 kWh/person/year, which is the average rate of all the BEN's customer in Baku in 1999, to 1,000 kWh/person/year in 2010. Though the possibility of adjusting the consumption rate of all the districts uniformly to 1,000 kWh/person/year in 2010 was considered, this approach was not adopted. Since the population data provided by the Baku City statistical office has a problem of possibly underestimating the actual population, this approach could overestimate the rate of reduction in energy consumption per capita. This could result in underestimating the need for power distribution system development. In the event that the consumption rate is calculated to decline lower than 1,000 kWh/person before 2010, the rate is not to decline below 1,000 kWh/person and assumed to remain constant at 1,000 kWh/person until 2010.

In the event that the energy consumption per capita in 1999 is lower than 1,000 kWh/person/year, the consumption rate in 1999 is assumed to remain constant until 2010. Theoretically speaking, the consumption rate per capita in the future will be determined by income elasticity and price elasticity of energy use. Data on these aspects, however, are non-existent. It is assumed in the present forecast that the per capita consumption rate in 1999 lower than 1,000 kWh could be interpreted as the sufficient level to meet daily needs, since the customers opt to use the energy at the present level even though higher consumption is possible without making additional payment under the present tariff collection system. In this case, the impact of income rise is assumed to be cancelled out by the impact of electricity tariff system reform.

7.2.2 Industrial and Other Energy Demand

Energy consumption for "industrial" and "other" uses is assumed to grow with the following assumptions.

- Production increase: 6.0% per year (referring to long-term outlook of international organizations for non-oil sector growth)
- Elasticity: 1.0 applied. A wide range is observed in the elasticity in the world: 0.2 to 4.0 for industrial use and 0.2 to 2.5 for other use.

These electric users are generally considered more cost-conscious and using energy efficiently. There would not be much room for reducing wasteful use. In order to expand their activities, it would be inevitable for them to increase energy use.

7.2.3 Loss

Loss in 2010 is set at 10% of the purchased energy for all the districts, including both technical and non-technical losses, except in Nizami district. The loss rate in Nizami was 8.4% in 1999, already lower than 10%. The loss rate in Nizami, therefore, is set at 8.4% also in 2010. The loss rate in 1999 for Sabail, Yasamal, Nasimi and Narimanov districts is set at 19.2%, the average loss rate of the city area, since no data were available for each district. The loss rate in Khatai was 13.5% in 1999. Concerning the area outside the study area, the loss rate was controlled at 17.3%, which makes the loss rate of the total demand in Baku at 17.0%.

7.2.4 Annual Energy and Peak Power Demand

Annual energy consumption is forecast for every year until 2010, applying the average annual rate of change between 1999 and 2010 for each district. Peak demand for each district is estimated with a load factor at 0.55.

7.3 Result

The "Save-energy scenario" for residential energy is adopted considering the following points.

- It would be realistic to assume that some kind of institutional reform programs be implemented for various kinds of public services including power supply by 2010.
- It would be necessary for BEN to take some measures to restrain demand. The level of growth under the " high growth scenario " with the demand in 2010 about 2 times the 1999 level, is difficult to cope with.

The forecast energy consumption by BEN's customer is shown in Appendix II.7.3-1, II.7.3-2 and II.7.3-3 and summarizes below:

Table II.7.3-1 Result of energy demand forecast

Item	1999	2010	Rate of change (%/year)
A. Study area			
BEN's sold energy (GWh)	1,519	1,905	2.1
Residential consumption (GWh)	*1,253*	*1,398*	*1.0*
Industrial consumption (GWh)	*36*	*68*	*6.0*
Other consumption (GWh)	*231*	*438*	*6.0*
Loss (GWh)	305	206	-3.5
BEN's purchased energy (GWh)	1,824	2,111	1.3
Peak demand (MW)	379	438	1.4
B. Outside study area			
BEN's sold energy (GWh)	1,483	1,757	1.6
BEN's purchased energy (GWh)	1,793	1,953	0.8
Peak demand (MW)	372	405	0.8
C. Total in Baku City (A+B)			
BEN's sold energy (GWh)	3,002	3,662	1.8
BEN's purchased energy (GWh)	3,617	4,064	1.1
Peak demand (MW)	751	844	1.1

Note: Demand outside the study area includes that classified as " inspection ".

Appendix II.7.3-4 shows the amount of energy use per residential customer in 1999 and 2010 in two scenarios estimated based on the forecast energy use and the number of residential customers assumed to grow at 2.6 per year, the same growth rate as the population. The following is a summary.

1999:		5,758 kWh/customer/year
2000:	"High-growth scenario"	8,320 kWh/customer/year
	"Save-energy scenario"	4,847 kWh/customer/year

Appendix II.7.2-1 Estimate of Electricity Use for Heating in Winter in Baku

Month	(a) Amount of Electricity Sold by BEN by Month in 1998 (GWh)	Electricity Consumption per capita (kWh/person)		
		(b) Total	(c) Non-heating purpose	(d) Heating purpose
January	279.3	125.2	89.4	35.9
February	284.4	127.5	89.4	38.2
March	280.8	125.9	89.4	36.6
April	228.0	102.2	89.4	0
May	188.9	84.7	89.4	0
June	184.7	82.8	89.4	0
July	190.8	85.6	89.4	0
August	204.7	91.8	89.4	0
September	190.7	85.5	89.4	0
October	207.2	92.9	89.4	0
November	246.1	110.4	89.4	21.0
December	316.9	142.1	89.4	52.7
Total	2,802.5	1,256.6	1,072.3	184.3

Source : Energy Sales Enterprise

Note :

Population in 199 1,788.6 thousand

Proportion of residential consumption : 80.20%

(b) (a) / population * 80.2%

(c) Average of b. between April and October

(d) Difference between b. and c. between November and March. No heating consumption is assumed between April and October

Appendix II.7.3-1 Residential Electricity Demand of BEN Customers for 2010 under Two Scenarios

District	1999			2010						
					High Growth Scenario			Save-energy Scenario		
	Electricity consumption (GWh)	Population (thousand)	Electricity consumption per person (kWh/person)	Population (thousand)	Electricity consumption per person (kWh/person)	Total electricity consumption (GWh)	Annual average growth rate (%/year)	Electricity consumption per person (kWh/person)	Total electricity consumption (GWh)	Annual average growth rate (%/year)
(Study Area)										
1 Sabail	166.0	74.3	2,234	98.5	3,227	318.0	6.1	1,616	159.2	-0.4
2 Yasamal	215.9	221.5	975	293.8	1,408	413.7	6.1	975	286.4	2.6
3 Nasimi	221.3	195.8	1,130	259.7	1,632	423.9	6.1	1,000	259.7	1.5
4 Narimanov	200.5	147.9	1,356	196.2	1,959	384.2	6.1	1,000	196.2	-0.2
5 Nizami	173.5	159.1	1,091	211.0	1,575	332.4	6.1	1,000	211.0	1.8
6 Khatai	275.2	215.5	1,277	285.8	1,845	527.3	6.1	1,000	285.8	0.3
Subtotal	1,252.5	1,014.1	1,235	1,344.9	1,784	2,399.4	6.1	1,040	1,398.3	1.0
(Outside Study Area)										
7 Garadagh	63.1	94.3	669	125.1	967	120.9	6.1	669	83.7	2.6
8 Binagadi	291.9	209.3	1,395	277.6	2,015	559.3	6.1	1,009	280.1	-0.4
9 Sabunchi	369.9	188.6	1,961	250.1	2,833	708.7	6.1	1,419	354.9	-0.4
10 Azizbayov	326.7	116.5	2,804	154.5	4,051	625.9	6.1	2,029	313.5	-0.4
11 Surakhany	161.7	165.8	976	219.9	1,409	309.9	6.1	976	214.5	2.6
Subtotal	1,213.4	774.5	1,567	1,027.2	2,263	2,324.7	6.1	1,214	1,246.7	0.2
TOTAL	**2,465.9**	**1,788.6**	**1,379**	**2,372.1**	**1,992**	**4,724.1**	**6.1**	**1,115**	**2,645.0**	**0.6**

Assumptions :

(1 Rate of population increase : 2.6% per year

(2 High growth scenario " The present rate of electricity charge collection and tariff level remains. "
- Economic growth 6.0% per year
- Rise in household income: 3.4% per year (6.0% minus 2.6%)
- Elasticity 1.0

(3 Save-energy scenario " Electricity consumption will approach ordinary country level as a result of an improvement in charge collection and a new tariff system. "
Electricity consumption per capita is assumed at : 1,000 kWh per person, including regular demand (800 kWh/person) and heating demand (200kWh/person).
For districts with the per capita consumption rate higher than 1,000 kWh in 1999, the rate will decline at the following rate.
- 1999 1,379 kWh per person
- 2010 1,000 kWh per person
- Rate of change : -2.9 % per year

Decline in per capita consumption rate is assumed to stop at 1,000 kWh per person. The districts with consumption rate lower than 1,000 kWh in 1999 will maintain its 1999 consumption rate.

(4 Electricity use for "Inspection" in 1999 is allocated to each district in proportion to the residential electricity use in each district.
Total electricity use for "Inspection" in 1999: 12.9 GWh

Appendix II.7.3-2 Electricity Demand of BEN Customers in 2010

District	1999							2010							Growth Rate (%/year)					
	Sold Electricity (GWh)				Loss		Purchased electricity (GWh)	Sold Electricity (GWh)				Loss		Purchased electricity (GWh)	Sold Electricity				Loss	Total
	Residential demand	Industrial demand	Other demand	Sub-total	(%)	(GWh)		Residential demand	Industrial demand	Other demand	Sub-total	(%)	(GWh)		Residential demand	Industrial demand	Other demand	Sub-total		
(Study Area)																				
1 Sabail	166.0	4.9	55.5	226.4	19.2	53.8	280.2	159.2	9.3	105.4	273.9	10.0	30.4	304.3	-0.4	6.0	6.0	1.7	-5.0	0.8
2 Yasamal	215.9	4.3	40.5	260.8	19.2	62.0	322.8	286.4	8.2	77.0	371.5	10.0	41.3	412.8	2.6	6.0	6.0	3.3	-3.6	2.3
3 Nasimi	221.3	1.5	37.1	259.9	19.2	61.8	321.7	259.7	2.9	70.5	333.0	10.0	37.0	370.1	1.5	6.0	6.0	2.3	-4.5	1.3
4 Narimanov	200.5	7.3	38.4	246.3	19.2	58.5	304.8	196.2	13.9	72.9	283.0	10.0	31.4	314.4	-0.2	6.0	6.0	1.3	-5.5	0.3
5 Nizami	173.5	8.1	23.2	204.8	8.4	18.8	223.6	211.0	15.3	44.1	270.4	8.4	24.8	295.2	1.8	6.0	6.0	2.6	2.6	2.6
6 Khatai	275.2	9.9	36.0	321.2	13.5	50.1	371.3	285.8	18.9	68.3	373.0	10.0	41.4	414.5	0.3	6.0	6.0	1.4	-1.7	1.0
Subtotal	1,252.5	36.0	230.9	1,519.3	16.7	305.0	1,824.3	1,398.3	68.4	438.2	1,904.9	10.0	206.4	2,111.3	1.0	6.0	6.0	2.1	-3.5	1.3
(Outside Study Area)	1,213.4	92.0	177.1	1,482.5	17.3	310.1	1,792.6	1,246.7	174.6	336.1	1,757.4	10.0	195.3	1,952.7	0.2	6.0	6.0	1.6	-4.1	0.8
TOTAL	2,465.9	128.0	407.9	3,001.8	17.0	615.1	3,616.9	2,645.0	243.0	774.4	3,662.3	9.9	401.7	4,064.0	0.6	6.0	6.0	1.8	-3.8	1.1

Assumption:

(1) Electricity demand for industrial and other purposes is projected based on the following assumptions.

Rate of economic growth : 6.0% per year

Elasticity of demand to economic growth : 1.0

(2) Residential electricity demand : Save-energy Scenario

(3) Loss rate assumed : 1999 : Sabail, Yasamal, Nasimi, Narimanov : 19.2 % (average of city area in 1999)

Nizami and Khatai : from data for each district in 1999

Outside study area : controlled at 17.3%, which makes the loss rate of the total of Baku 17.0%

2010 : 10.0% of the electricity purchased from Azenerji, including technical and non-technical loss, except for Nizami district where the loss rate in 1999 was 8.4%.

8.4% is used for Nizami district for 2010.

(4) "Inspection" consumption for industrial and other uses is allocated to each district in proportion to the industrial and other consumption respectively.

Inspection consumption for industrial use: 59.80 GWh

Inspection consumption for other use: 80.70 GWh

Appendix II.7.3-3 Annual Electricity Use and Peak Demand of BEN Customers by Year 2010

Year	Demand in the study area							Demand outside study area	Total demand
	Sabail	Yasamal	Nasimi	Narimanov	Nizami	Khatai	Total		
(Electricity demand in GWh)									
1999	280.2	322.8	321.7	304.8	223.6	371.3	1,824.3	1,792.6	3,616.9
2000	282.3	330.1	325.8	305.7	229.3	375.0	1,848.2	1,565.9	3,414.0
2001	284.4	337.5	330.0	306.5	235.2	378.8	1,872.4	1,588.0	3,460.4
2002	286.6	345.2	334.2	307.4	241.2	382.6	1,897.1	1,610.6	3,507.7
2003	288.7	353.0	338.5	308.3	247.4	386.4	1,922.3	1,633.5	3,555.8
2004	290.9	361.0	342.8	309.1	253.7	390.3	1,947.9	1,657.0	3,604.8
2005	293.1	369.1	347.2	310.0	260.2	394.2	1,973.9	1,680.8	3,654.7
2006	295.3	377.5	351.7	310.9	266.9	398.2	2,000.4	1,705.1	3,705.5
2007	297.5	386.0	356.2	311.8	273.7	402.2	2,027.4	1,729.9	3,757.3
2008	299.8	394.7	360.7	312.7	280.7	406.2	2,054.9	1,755.1	3,809.9
2009	302.1	403.7	365.4	313.5	287.9	410.3	2,082.8	1,780.8	3,863.6
2010	304.3	412.8	370.1	314.4	295.2	414.5	2,111.3	1,952.7	4,064.0
(Peak Demand in MW)									
1999	58.1	67.0	66.8	63.3	46.4	77.1	378.6	372.1	750.7
2000	58.6	68.5	67.6	63.4	47.6	77.8	383.6	325.0	708.6
2001	59.0	70.1	68.5	63.6	48.8	78.6	388.6	329.6	718.2
2002	59.5	71.6	69.4	63.8	50.1	79.4	393.8	334.3	728.0
2003	59.9	73.3	70.3	64.0	51.3	80.2	399.0	339.1	738.0
2004	60.4	74.9	71.2	64.2	52.7	81.0	404.3	343.9	748.2
2005	60.8	76.6	72.1	64.3	54.0	81.8	409.7	348.9	758.6
2006	61.3	78.3	73.0	64.5	55.4	82.7	415.2	353.9	769.1
2007	61.8	80.1	73.9	64.7	56.8	83.5	420.8	359.0	779.8
2008	62.2	81.9	74.9	64.9	58.3	84.3	426.5	364.3	790.8
2009	62.7	83.8	75.8	65.1	59.7	85.2	432.3	369.6	801.9
2010	63.2	85.7	76.8	65.3	61.3	86.0	438.2	405.3	843.5

Note : (1) Annual hours : 8,760
(2) Load factor : 0.55
(3) Electricity demand in each year is interpolated applying annual average growth rates between 1999 and 2010 for respective district.

Appendix II.7.3-4 Electricity Use per BEN Residential Customer in 1999 and 2010

District	1999			2010							
				" High Growth Scenario "				"Save-energy Scenario "			
	Number of residential customer	Electricity consumption (GWh)	Electricity consumption per customer (kWh)	Number of residential customer	Electricity consumption (GWh)	Electricity consumption per customer (kWh)	Rate of change in electricity consumption per customer (%/year)	Number of residential customer	Electricity consumption (GWh)	Electricity consumption per customer (kWh)	Rate of change in electricity consumption per customer (%/year)
(Study Area)											
1 Sabail	27,110	166.0	6,122.0	35,954	318.0	8,845	3.4	35,954	159.2	4,427.9	-2.9
2 Yasamal	31,121	215.9	6,938.4	41,274	413.7	10,023	3.4	41,274	286.4	6,939.0	0.0
3 Nasimi	38,434	221.3	5,756.9	50,972	423.9	8,316	3.4	50,972	259.7	5,095.0	-1.1
4 Narimanov	31,306	200.5	6,406.0	41,520	384.2	9,253	3.4	41,520	196.2	4,725.5	-2.7
5 Nizami	36,279	173.5	4,782.6	48,114	332.4	6,909	3.4	48,114	211.0	4,385.4	-0.8
6 Khatai	53,257	275.2	5,168.1	70,632	527.3	7,465	3.4	70,632	285.8	4,046.3	-2.2
Subtotal	217,507	1,252.5	5,758.2	288,466	2,399.5	8,318	3.4	288,466	1,398.3	4,847.4	-1.6
(Outside Study Area)											
7 Garadagh	12,163	63.1	5,190.2	16,132	120.9	7,495	3.4	16,132	83.7	5,188.6	0.0
8 Binagadi	44,849	291.9	6,509.2	59,480	559.3	9,403	3.4	59,480	280.1	4,709.2	-2.9
9 Sabunchi	33,434	369.9	11,064.7	44,341	708.7	15,983	3.4	44,341	354.9	8,003.8	-2.9
10 Azizbayev	20,044	326.7	16,296.7	26,584	625.9	23,544	3.4	26,584	313.5	11,792.9	-2.9
11 Surakhany	31,572	161.7	5,123.1	41,872	309.9	7,401	3.4	41,872	214.5	5,122.8	0.0
Subtotal	142,062	1,213.4	8,541.3	188,408	2,324.7	12,339	3.4	188,408	1,246.7	6,617.0	-2.3
Baku Total	**359,569**	**2,465.9**	**6,857.8**	**476,874**	**4,724.2**	**9,906.6**	3.4	**476,874**	**2,645.0**	**5,546.5**	**-1.9**

Assumptions:

(1)	Number of residential customer in 1999:	Only the total figure at 359,569 were obtained. Allocation to districts was made applying the each district's proportion in 1998.
(2)	Electricity consumption in 1999:	" Inspection " consumption is allocated to each district in proportion to each district share.
(3)	Number of residential customer in 2010:	Assumed to grow in proportion to population growth at 2.6 %/year.
(4)	Electricity consumption in 2010:	As projected for two cases.

CHAPTER 8

IMPLEMENTATION PLAN AND COST ESTIMATE

Chapter 8 IMPLEMENTATION PLAN AND COST ESTIMATE

8.1 Implementation plan

8.1.1 Distribution facilities

The Master Plan for rehabilitation and reconstruction of distribution network over next 10 years is detailed in Chapter 5 and 6 in this Volume. Quite large amount of funding needs to be invested to implement the Master Plan. It is considered that it is very difficult for BEN to commit its own finance on the Master Plan, taking into account the record of fund invested by BEN so far during the past ten year. Accordingly, financial assistance by foreign governments and international assistance organization is deemed necessary to smoothly implement the Master Plan.

In this Study, the cost estimate and evaluation for the Master Plan project are made based on the condition that the financial assistance from foreign sources is available, and that the Master Plan project is implemented over next ten years in three phases. Considering the total plan over ten years, the first four years is termed as the first phase, with next three years as the second phase and the remaining 3 years as the third phase. The facilities identified for rehabilitation and major equipment and materials to be procured in each phase is shown in Table II.8.1-1, and detailed in Appendix II.8.1-1.

Table II.8.1-1 Rehabilitation facilities and procurement in each phase

	First Phase	Second Phase	Third Phase	Total
Facilities to be rehabilitated				
MV line length (km)	93.1	70.1	69.7	232.9
Transformer stations (No.)	106	78	78	262
Major equipment/materials to be procured				
Cables : MV (km)	197.3	148.7	147.8	493.8
: LV (km)	246.9	153.2	183.9	583.9
Transformer capacity (MVA)	90.7	59.5	66.1	216.3
MV switchgear : CB panel	370	276	231	877
: LBS panel*1	603	438	411	1,452

Note*1: including bus-tie, transformer panel

The locating relationship between the underground lines and transformer stations to be rehabilitated during the first phase is shown in Figures II.8.1-1 (1)-(5), with that of the second in Figures II.8.1-2 (1)-(5) and that of the third in Figures II.8.1-3 (1)-(5). As is evident from those Figures, the first phase covers most of the facilities in the central area of Baku City, for which BEN has strongly longed urgent rehabilitation and reconstruction. The existing facilities is indicated in blue for 10 kV and in green for 6 kV, and the facilities to be rehabilitated is indicated in red with those completed in black in each phase. It is also noted in the said Figure that the number of circuit of the underground lines completed and to be rehabilitated (double circuit in principle) is adjusted to be the same as that of existing ones.

The development and expansion plan for the upstream transmission system and the trend of electricity demand will affect the distribution network plan. Accordingly, the Master Plan formulated in this Study needs to be reviewed in accordance to the progress of transmission system development and demand performance. Therefore, it is reasonable that the Master Plan for distribution network be annually reviewed based on the regular review of these conditions including electricity demand. The actual situation needs to be studied particularly before the implementation of the second and third phase plans.

8.1.2 Load Dispatching Facilities

The rehabilitation of the load dispatching system is drawn up as described in Chapter 6 and divided into two phases from the economical point of view. The greater part of the plan is carried out at the same time with the second stage rehabilitation of the Project.

The major equipment and materials to be procured for the rehabilitation work of load dispatching system are shown in Table II.8.1-2. The 35 kV substations are out of the scope of our investigation. Then, the number of 35 kV substation to be remotely supervised and controlled from CLDC is unknown and unable to list up in Table II.8.1-2. After completion of rehabilitation and improvements, the substations are remotely supervised and automatically controlled from CLDC. The items marked with circle on column of third stage in the table show the addition and/or modification of the software for the equipment installed in the phase II.

Table II.8.1-2 Major facilities for load dispatching system

	Phase I	Phase II	Phase III	Total
Central Load Dispatching Center				
Distribution network supervisory control unit (main)	–	1	O	1
Distribution network supervisory control unit (backup)	–	1	O	1
Dispatcher terminal	–	3	O	3
Large size screen type display	–	1	O	1
Distribution network diagram display panel	–	1	O	1
Substation SV/TM display panel	–	1	O	1
Radio communication control equipment	–	1	–	1
Substation supervisory control unit (master unit)	–	1	O	1
Training terminal	–	–	1	1
Office terminal	–	–	3	3
Transformer Station				
RTU	–	184	78	262
35 kV substation				
Substation supervisory control unit (sub unit)	–	–	–	–

Note: Rehabilitation work of load dispatching system is to be started at the phase II

8.2 Procurement of Equipment and Materials

8.2.1 Means of procurement

(1) Distribution facilities

Considering a discussion of basic approach for formulating Master Plan in Chapter 4 in this Volume, it is considered as technically difficult to procure the equipment and materials necessary for distribution network rehabilitation from the FSU countries as BEN has done in the past. Procurement of medium voltage switchgears is particularly problematic. The problem here is not in the availability with required specification, but the size of the SF6-gas type and Vacuum type switchgears. Most of the transformer stations identified in the Master Plan were designed so as to correspond to the distribution system comprised by single circuit line. Therefore, those transformer stations are too small to accommodate the medium voltage switchgears for the system upgraded with double circuit line, and need to be sufficiently expanded. In this case, the following difficulties are anticipated:

(a) Among the ground-mounted type transformer stations, those located in the park and green-belt area have sufficient space for expansion. However, the others have generally lack of space. It is also noted that most of the rented room type stations face the difficulty in expanding the space, and a lack of alternative room.

(b) Continuous energy supply needs to be ensured during the rehabilitation works. In addition, those transformer stations identified for rehabilitation are concentrated in high demand density area, and have a larger number of cable connected customer, posing the possibility of power interruption. The expansion works for these transformer stations under this situation will bring about the problem in terms of stable energy supply, if the works are prolonged.

Consequent to the examination on these matters, the international competitive bidding, which can procure the switchgears requiring partly renovation of transformer stations, is considered as valid. Even in this case, however, the layout of the transformer stations to be rehabilitated and bidding conditions are clearly shown and stipulated in the bidding document.

(2) Load Dispatching Facilities

The load dispatching system as explained in Chapter 6 comprise telecommunication and control equipment and devices applying modern electronic technology and their performances are rapidly progressing by free competition

In this plan, to display the location of distribution lines on the electrical map is intended using the graphic information system (GIS). However, at present, a graphic information electrical map of the whole of

Azerbaijan is under preparation with the assistance of the Government of Japan. Then, now it is not available the detailed graphic information electrical map for the project area. To prepare the detailed graphic information map of the project area is not considered by the project because this would require a lot of money and therefore beyond the scope of the project.

The quality of software has an important function on the computerized load dispatching system in the same as or more than that of hardware function. Therefore, it is important that the load dispatching system is to be procured from a supplier who has an ample experience and capability in this kind of project. International competitive bidding will be applied to procure the equipment and devices under the detailed technical specifications on the data transmission protocol, telecommunication equipment Interface between equipment and devices, etc.

8.2.2 Unit Price for Cost Estimate of the Master Plan Project

Standard unit price table prepared by electricity business contractor is generally available for the cost estimation. However, since the unit prices used by BEN are as of before the collapse of FSU, the equipment in the list is not appropriate for application in the Master Plan. Procurement activity by international competitive bidding has not been practiced at all by BEN. Accordingly, the Study Team prepares the standard unit prices with reference to recent information on international competitive bidding and price quotations of the manufacturing markets. As the contracted amount for project implementation has a tendency to increase in accordance to contract change and additional works, some allowance for the estimates needs to be made. The standard unit prices (FOB) for equipment and materials are adopted as shown in Appendix II.8.2-1.

On the standard unit price table for load dispatching and communication facilities used by BEN is observed the similar situation and the table is not available. The unit prices are prepared by the Study Team with reference to recent information on international competitive bidding and price quotations of the manufacturing makers, and presented in Appendix II.8.2-2

8.3 Approach for the Project Cost Estimation

8.3.1 Distribution facilities

BEN has procured the necessary equipment and materials from both abroad and domestic providers on its own terms, and implemented project works for itself or consigned the contractor with the works. Also, the procurement of equipment and materials is sometimes included in the project works contract. As is already discussed, however, the equipment and materials needs to be procured in accordance with various conditions stipulated in the bidding document, and the unfamiliar installation and adjustment works with the latest technology for BEN and local contractors need to be undertaken. Therefore, it is considered as appropriate that the rehabilitation works of the distribution network including procurement be contracted to an experienced foreign contractor on a turnkey basis. It is assumed, however, that Azerbaijan's local contractor shall cover the major part of project work on sub-contract basis. Underground cables works in the central area of the city in particular require the active local participation, considering the difficulties in approval and permission procedures.

It is considered as very difficult to forward the cable laying works in accordance with transformer station rehabilitation works, due to the difficulty in obtaining timely approval and permission, and ensuring traffic control. Therefore, the works of transformer stations and underground cables have to be independently forwarded, while minimizing the time difference in the progress. The items of project works in the Master Plan are as follows:

(1) Replacement of transformer station facilities

The following items are included in transformer station works:

(a) Installment of temporary transformer and switchgear, and the existing cable connection with those temporary facilities to ensure continuous energy supply to customers

(b) Removal of the existing switchgear, transformer and bus-bar

(c) Renovation and repair of transformer station house (even the house requiring no partition layout change to MV facilities needs the works for cable duct and supporting structure for the facilities)

(d) Installment, adjustment and inspection of switchgear and transformer

(e) Connection switch to newly installed switchgear after removal of temporary one

(f) Connection of cable to switchgear after the completion of underground cable works

(2) Underground cable line

The items of underground cable works are as follows. It is noted that BEN does not remove the existing overage cables as long as no obstacles are found in the laying works of the new cable.

(a) Measurement and survey of cable laying route and other laid stuff, and Formulation of cable laying plan (the approval for cable laying works needs to be obtained based on this result)

(b) Excavation (excavated sand needs to be temporarily removed from the area with narrow road and tight traffic regulations)

(c) Cable laying and cable protection works

(d) Refilling and pavement of sidewalk and road (the pavement works are normally undertaken by

Road Construction Section of Baku City)

Most of the above items of project works can be undertaken by Azerbaijan's local contractor on a sub-contract basis under the full responsibility held by the experienced foreign contractor.

The cost for the project works undertaken by local sub-contractor is estimated based on the past records. Cost estimation for public works including distribution network project in Azerbaijan is made in the manner given under. However, the method is very complicated, and is unfortunately not understood sufficiently well by the Study Team though the discussions on this method have been done several times.

(a) All of the cost estimation for public works is done by the Public Design Institute to obtain the approval for construction works and bidding. The expenses incurred by this activity shall be borne by the implementing organization.

(b) The cost estimation method is detailed for each facility and kind of works. Those regulations were prepared in the FSU period, and the unit prices were as of 1991 in Ruble currency.

(c) Construction cost estimated by the unit prices as of 1991 in Ruble currency is converted into AZM terms as of 1991 (1AZM=10 Rubles), and adjusted in accordance to the price level at the time of planning.

As an example, the estimation result for the laying works of 10 kV underground cables with four circuit lines (3×185 mm^2: 1,160 m) is shown in Table II.8.3-1. Labor cost (2.0 % of the construction cost) as contribution to the Employment Fund, general and managerial expenses (0.228 %) and VAT (20 %) is added to the construction cost in the Table. The exchange rate from AZM to USD is USD1 = AZM 4,456.00 (as of May 31, 2000). The material cost in the table includes the cost for the accessory items such as cables (4.87 km), straight joints and cable terminals.

Table II.8.3-1 Example of the estimation (the laying works of underground cables)

Items	Base estimate (AZM,1991)	Adjustment factor	Construction cost (1,000AZM)	Construction cost (USD)
Material cost (inc. cables)	8,508	50,053	425,848.5	95,567
Labor cost	412	21,056	8,674.9	1,947
Machinery cost	190	36,064	6,852.2	1,538
General/managerial cost	339	17,258	5,850.6	1,313
Plan accumulation	756	27,759	20,986.0	4,710
Total	10,205	45,881	468,212.5	105,075

8.3.2 Load Dispatching Facilities

As stated in Section 8.2, the facilities comprising the load dispatching system will be procured by international competitive bidding and all of equipment and devices will be of foreign make. Erection, adjustment and testing at site are important items of the work to get the full functional performance of the system. Modification of software is required as a result of site tests. The contract for the load dispatching system should be made in turnkey base including design, manufacture, deliver to site, test and commission through international competitive bidding.

It is difficult to get an information on local portion of erection cost for load dispatching facilities because there is little local erection experience in Azerbaijan on local erection of large scale computer aided control facilities. Local erection contractors on power and telecommunication facilities in Azerbaijan will participate as the subcontractors of foreign contractors. Local portion of erection cost is estimated at 20 % of total erection cost taking account of bidding method.

8.4 Project Cost

The project cost is estimated in accordance to the explanation in Section 8.1, 8.2 and 8.3, and shown in Table II.8.4-1. The cost for engineering consulting to undertake construction supervision followed by the detail design and bidding support is estimated as 8 % of the total direct project cost, and 10 % of the total direct project is allowed as contingency portion.

Table II.8.4-1 Project cost summary (USD 1,000)

	First phase	Second phase	Third phase	Total
1) Distribution facilities				
Equipment/material (CIF)	28,942	19,641	20,020	68,603
Construction cost: foreign cost portion	5,625	3,858	3,970	13,453
Construction cost: local cost portion	4,503	3,163	3,328	10,994
Sub-total	39,070	26,662	27,318	93,050
2) Load dispatching facilities				
Equipment/material (CIF)	-	9,842	2,612	12,454
Construction cost: foreign cost portion	-	270	66	336
Construction cost: local cost portion	-	67	16	83
Sub-total	-	10,179	2,694	12,873
1) + 2)				
Equipment/material (CIF)	28,942	29,483	22,632	81,057
Construction cost: foreign cost portion	5,625	4,128	4,036	13,789
Construction cost: local cost portion	4,503	3,230	3,344	11,077
Sub-total	39,070	36,841	30,012	105,923
Detail design and construction supervision	3,126	2,947	2,401	8,474
Contingency portion	3,907	3,684	3,001	10,592
Total	46,103	43,472	35,414	124,989