ANNEX

MAIN CHARACTERISTICS OF GEORGIAN POWER PLANTS

by the state of 1990 and 1999

TABLE 1-1

No	Electricity generation plants	Installed capacity, MW		Designed output of electricity, Thousand KWh		Actual generation of electricity, Thousand KWh		Installed capacity use factor				Actual generation of thermal energy, MWh	
								Designed %		Actual %			
1	2	3		4		5		6		7		8	
	THERMAL ELECTRIC STATIONS												
		1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
1	Tbilsresi	1400	1700	8400	10200	5578.1	1609,6	68,49	68,49	45,48	10,8	103982	1163
2	Tkvarchelsresi	220	0	1320	0	344	0	68,49	0	17,9	0	0	0
3	Tbiltetsi (Tbilisi CHP)	18	18	108	108	96,2	24,2	68,49	68,49	61	15,34	437015	32010
Total for thermal electric plants		**1638**	**1718**	**9828**	**10308**	**6018,3**	**1633,8**	**68,49**	**68,49**	**41,94**	**10,35**	**540997**	**33173**
	HYDRO POWER PLANTS												
		1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
4	Engurhesi	1300	1300	4340	4340	3579,3	2684,1	38,11	38,11	31,43	23,56	-	-
5	Vardnilhesi-1	220	220	700	700	643,6	525,4	36,32	36,32	33,39	27,26	-	-
6	Vardnilhesi-2	40	0	127	0	116	0	36,24	0	33,11	0	-	-
7	Vardnilhesi-3	40	0	127	0	112,9	0	36,24	0	32,22	0	-	-
8	Vardnilhesi-4	40	0	137	0	112,5	0	39,09	0	32,1	0	-	-
9	Khramhesi-1	113,45	113,45	217	217	198,2	217,1	21,83	21,83	19,94	21,83	-	-
10	Khramhesi-2	110	110	370	370	285,3	207,5	38,39	38,39	29,6	21,53	-	-
11	Jinvalhesi	130	130	500	500	361,6	362	43,9	53,9	31,75	31,78	-	-
12	Shaorhesi	38,4	38,4	148	148	134,7	167,2	43,99	43,99	40,04	49,7	-	-
13	Tkibulhesi	80	80	165	165	165,9	133,8	23,54	23,54	23,67	19,09	-	-
14	Rionhesi	48	48	325	325	247,2	243.8	77,25	77,25	58,76	58,76	-	-
15	Gumathesi-1	44	44	394	394	141	156	66,41	66,41	36,58	40,47	-	-
16	Gumathesi-2	22,8	22,8	138	138	70,7	79,2	69,09	69,09	35,39	39,65	-	-
17	Vartsikhehesi	184	184	1400	1400	851,4	809	86,85	86,85	52,82	50,19	-	-
18	Lajanur hesi	111,84	111,84	505	505	357,1	344	51,54	51,54	36,44	35,11	-	-
19	Zahesi	36,8	36,8	210	210	137,9	141,6	65,14	65,14	42,77	43,92	-	-
20	Ortachalhesi	18	18	90	90	69,2	68,6	57,07	57,07	43,88	43,5	-	-
21	Atshesi	16	16	97	97	63,1	58,6	69,2	69,2	45,01	41,8	-	-
Total for hydro power plants		**2593,29**	**2473**	**9852**	**9461**	**7305,2**	**6197,9**	**43,36**	**43,66**	**32,15**	**28,60**	**-**	**-**

ENERGY RESOURCES CONSUMPTION AT THERMAL ELECTRIC PLANTS

Table 1 - 2

½	Electricity generation plants	Annual consumption of natural gas, Million m^3		Annual consumption of Mazut, Thousand ton		Specific consumption of conventional fuel, Gram Conditional Fuel/KWh			
						Electricity		Heat	
1	2	3		4		5		6	
	THERMAL ELECTRIC STATIONS								
		1990ü	1999ü	1990ü	1999ü	1990ü	1999ü	1990ü	1999ü
1	Tbilsresi	481,56	477,81	1431,9	84,07	467,09	441,4	155,172	172
2	Tkvarchelsresi	0	0	0	0	0	0	0	0
3	Tbiltetsi (Tbilisi CHP)	58,048	15,221	23,613	0	411,96	525,02	151,465	205,9
Total value for thermal electric plants		**539,61**	**493,03**	**1455,51**	**84,07**	**-**	**-**	**-**	**-**

CHARACTERISTICS OF THERMAL ELECTRIC STATIONS' MAIN UNITS
by the state of 1990 and 1999

TABLE 2-1

No.	Thermal Elwctric Station	Number of unit at the thermal electric stations'	Date of putting into operation, year	Depreciation period of the unit	Date of last overhaul, year	Privatization Status of the unit		Turbines						Boilers							
								Nominal capacity, MW		Steam pressure, Atm.		Steam temperature, ^{0}C		Productivity, T/h		Steam pressure, Atm.		Steam temperature, ^{0}C		Efficiency %	
						1990ü	1999ü	1990ü	1999ü	1990ü	1999ü	1990ü	1999ü	1990ü	1999ü	1990ü	1999ü	1990ü	1999ü	1990ü	1999ü
1	TBILSRESI	1	1963	17	1971	No	No	150	150	130	130	565	565	500	500	140	140	570	570	92,5	85,8
		2	1964	17	1972	No	No	150	150	130	130	565	565	500	500	140	140	570	570	92,5	85,8
		3	1965	17	1995	No	No	150	150	130	130	565	565	500	500	140	140	570	570	92,5	85,8
		4	1967	17	1999	No	No	160	160	130	130	565	565	500	500	140	140	570	570	92,5	85,8
		5	1968	17	1988	No	No	160	160	130	130	565	565	500	500	140	140	570	570	92,5	85,8
		6	1969	17	1989	No	No	160	160	130	130	565	565	500	500	140	140	570	570	92,5	85,8
		7	1971	17	1987	No	No	160	160	130	130	565	565	500	500	140	140	570	570	92,5	85,8
		8	1972	17	1995	No	No	160	160	130	130	565	565	500	500	140	140	570	570	92,5	85,8
		9	1990	17	-	No	No	300	300	240	240	540	540	1000	1000	255	255	545	545	93,3	93.3
		10	1994	17	-		No		300		240		540		1000		255		545		93.3
2	TBILTETSI	1	1939	17	1993	No	No	6	6	35	35	435	435	50	50	40	40	440	440	89	89
		2	1940	17	1996	No	No	6	6	35	35	435	435	50	50	40	40	440	440	89	89
		3	1958	17	1989	No	No	6	6	35	35	435	435	35	35	43	43	440	440	87	87
		4	1958	17	1989	No	No		0		0		0	35	35	43	43	440	440	87	87
3	TKVARCHELSRESI	1	1977	17	1989	No	No	110	0	90	0	535	0	220	0	100	0	540	0	N.A.	0
		2	1978			No	No	0	0	0	0	0	0	220	0	100	0	540	0	N.A.	0
		3	1980	17		No	No	110	0	90	0	535	0	220	0	100	0	540	0	N.A.	0
		4	1984			No	No	0	0	0	0	0	0	220	0	100	0	540	0	N.A.	0

_ Not functioning

CHARACTERISTICS OF THERMAL ELECTRIC STATIONS' MAIN UNITS

by the state of 1990 and 1999

Table 2-2

No.	Thermal electric stations	number of unit at the thermal electric stations	GENERATORS												EFFICIENCY			
			Total electric capacity, MW		Active power, MWA		Reactive power, MWR		Terminal voltage, kV		COS φ		Efficiency, %		Designed efficiency of unit, %		Actual efficiency of station, %	
			1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
1	TBILSRESI	1	176,5	176,5	150	150	93	93	0	18	0,85	0,85	98,5	98,5	38,8	33,8	26	22,87
		2	176,5	176,5	150	150	93	93	18	18	0,85	0,85	98,5	98,5	38,8	33,8	26	22,87
		3	176,5	176,5	150	150	93	93	18	18	0,85	0,85	98,5	98,5	38,8	33,8	26	22,87
		4	176,5	176,5	150	150	93	93	18	18	0,85	0,85	98,5	98,5	38,8	33,8	26	22,87
		5	176,5	176,5	150	150	93	93	18	18	0,85	0,85	98,5	98,5	38,8	33,8	26	22,87
		6	176,5	176,5	150	150	93	93	18	18	0,85	0,85	98,5	98,5	38,8	33,8	26	22,87
		7	176,5	176,5	150	150	93	93	18	18	0,85	0,85	98,5	98,5	38,8	33,8	26	22,87
		8	176,5	176,5	150	150	93	93	18	18	0,85	0,85	98,5	98,5	38,8	33,8	26	22,87
		9	376	376	320	320	250	250	20	20	0,85	0,85	98,6	98,5	37,7	37,7	26	28,9
		10		376		320		250		20		0,85		98,5		37,7		28,9
2	TBILTETSI	1	7,5	7,5	6	6	4,5	4,5	6,3	6,3	0,8	0,8	97.6	97.6	33,2	33,2	29,8	23,43
		2	7,5	7,5	6	6	4,5	4,5	6,3	6,3	0,8	0,8	97.6	97.6	33,2	33,2	29,8	23,4
		3	7,5	7,5	6	6	4,5	4,5	6,3	6,3	0,8	0,8	97.6	97.6	33,2	33,2	29,8	23,4
		4	0	0	0	0	0	0	18	0	0	0	0	0	0	0	29,8	0
3	TKVARCHELHESI	1	0	0	120	0	0	0	18	0	0,85	0	98,43	0	31,1	0	20,5	0
		2	0	0	0	0	0	0	6,3	0	0	0	0	0	0	0	0	0
		3	0	0	120	0	0	0	6,3	0	0,85	0	98,43	0	31,1	0	20,5	0
		4	0	0	0	0	0	0	6,3	0	0	0	0	0	0	0	0	0

MAIN UNITS OF HYDRO POWER PLANTS AND THE IR CHARACTERISTICS
by the state of 1990 and 1999

Table 3-1

No	HPP	Date of putting into operation, year	Number of units		Capacity of units, MW		Installed capacity of hydro power plant, MW		Specific discharge of water, m^3/kWh		Rated water discharge for installed capacity, m^3/s		Specific discharge of water per kWh, m^3/kWh		Rated water discharge for annual generation, million m^3		Payload volume of reservoir, million m^3
1	2	3	4		5		6		7		8		9		10		11
			1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	
1	Engurhesi	1978	5	5	260	260	1300	1300	0,346	0,346	449,8	449,8	1,26	1,26	5468,4	5468,4	667
2	Vardnilhesi-1	1971	3	3	73,33	73,33	220	220	1,95	1,95	429	429	7,02	7,02	4914	4914	37
3	Vardnilhesi-2	1971	2	2	20	20	40	40	10,62		425		38,25		4590		
4	Vardnilhesi-3	1971	2	2	20	20	40	40	10,62		425		38,25		4590		
5	Vardnilhesi-4	1971	2	2	20	20	40	40	10,62		425		38,25		4590		
6	Khramhesi-1	1947	3	3	37,6	37,6	113,45	113,45	0,416	0,416	47,2	47,2	1,51	1,51	327,60	327,6	195
7	Khramhesi-2	1963	2	2	55	55	110	110	0,39	0,39	42,9	42,9	1,4	1,4	518	518	0,09
8	Jinvalhesi	1985	4	4	32,5	32,5	130	130	0,9	0,9	117	117	3,24	3,24	1620	1620	370
9	Shaorhesi	1955	4	4	9,6	9,6	38,4	38,4	0,3	0,3	11,44	11,44	1,07	1,07	158,36	158,36	64,5
10	Tkibulhesi	1956	4	4	20	20	80	80	0,47	0,47	37,2	37,2	1,67	1,67	275,55	275,55	37
11	Rionhesi	1933	4	3+1	12	3x12+ 1x13	48	49	2,08	2,08	99,84	99,84	7,48	7,48	2431	2431	
12	Gumathesi-1	1958	4	4	11	11	44	44	4,9	4,9	215,6	215,6	17,6	17,6	4506	4506	
13	Gumathesi-2	1956	3	3	7,6	7,6	22,8	22,8	10	10	228	228	36	36	4968	4968	
14	Vartsikhehesi	1976	8	8	23	23	184	184	7,6	7,6	350	350	27,36	27,36	6785	6785	
15	Lajanurhesi	1960	3	3	37,28	37,28	111,84	111,84	0,89	0,89	99,54	99,54	3,2	3,2	1616	1616	12,2
16	Zahesi	1927	4+2	4+2	4x3,2+ 2x12	4x3,2+ 2x12	36,8	36,8	6,4	6,4	235,52	235,52	23	23	4830	4830	
17	Ortachalhesi	1954	3	3	6	6	18	18	12,5	12,5	225	225	45	45	4050	4050	
18	Atshesi	1937	2	2	8	8	16	16	3	3	48	48	10,8	10,8	1048	1048	

__Are not functioning

MAIN UNITS OF HYDRO POWER PLANTS AND THE IR CHARACTERISTICS
by the state of 1990 and 1999

Table 3-2

No	HPP	TURBINE						GENERATOR								EFFICIENCY			
		Nominal capacity, MW		Rated water discharge, m^3/s		Efficiency, %		Nominal capacity, MW		Nominal voltage, kV		COS φ		Excitation voltage, V		Designed, %		Actual, %	
	2	12		13		14		15		16		17		18		19		20	
		1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
1	Engurhesi	260	260	90,85	450	95	95	260	260	15,75	15,75	0,85	0,85	250	250	38,11	38,11	31,43	23,56
2	Vardnilhesi-1	73,3	73,3	142	429	92	92	77	77	13,75	13,75	0,85	0,85	165	165	36,32	36,32	33,39	27,26
3	Vardnilhesi-2	20,7	0	206		89	0	20	0	3,15	0	0,8	0	tiristor		36,24	0	33,11	0
4	Vardnilhesi-3	20,7	0	206		89	0	20	0	3,15	0	0,8	0	tiristor		36,24	0	32,22	0
5	Vardnilhesi-4	20,7	0	206		89	0	20	0	3,15	0	0,8	0	tiristor		39,09	0	32,1	0
6	Khramhesi-1	38	38	12	47	89	89	37,6	37,6	10,5	10,5	0,8	0,8	230	230	21,83	21,83	19,94	21,83
7	Khramhesi-2	56,5	56,5	21,5	43	92	92	55	55	10,5	10,5	0,8	0,8	175	175	38,39	38,39	29,6	21,53
8	Jinvalhesi	33	33	29,25	117	93	93	32,5	32,5	10,5	10,5	0,8	0,8	175	175	43,9	53,9	31,75	31,78
9	Shaorhesi	10	10	2,45	11	88	88	9,6	9,6	10,5	10,5	0,8	0,8	115	115	43,99	43,99	40,04	49,7
10	Tkibulhesi	38,6	38,6	9,3	37	90	90	37,28	37,28	10,5	10,5	0,8	0,8	165	165	23,54	23,54	23,67	19,09
11	Rionhesi	12,5	13,5	2-28,2	102	87,5	87	12	12	6,6	6,6	0,8	0,8	115	115	77,25	77,25	58,76	58,76
12	Gumat hesi-1	11,5	11,5	53,5	216	90	90	11	11	6,3	6,3	0,8	0,8	187	187	66,41	66,41	36,58	40,47
13	Gumat hesi-2	7,95	7,95	71,3	228	89	89	7,6	7,6	6,3	6,3	0,8	0,8	200	200	69,09	69,09	35,39	39,65
14	Vartsikhehesi	23,8	23,8	175	350	91	91	23	23	10,5	10,5	0,8	0,8	200	200	86,85	86,85	52,82	50,19
15	Lajanur hesi	38,6	38,6	33,3	100	87	87	37,28	37,28	10,5	10,5	0,8	0,8	245	245	51,54	51,54	36,44	35,11
16	Zahesi	12,5	12,5	75	235	86,67	86,67	12	12	6,6	6,6	0,8	0,8	110/220	110/220	65,14	65,14	42,77	43,92
17	Ortachalhesi	6,3	6,3	76	225	87	87	6	6	6,3	6,3	0,8	0,8	150	150	57,07	57,07	43,88	43,5
18	Atshesi	6,3	6,3	24	48	86	86	8	8	6,6	6,6	0,8	0,8	220	220	69,2	69,2	45,01	41,8

- Are not functioning

ELECTRICITY EXPORT, IMPORT, GENERATION AND CONSUMPTION IN GEORGIA

by the state of 1990 and 1999

Table 4

#	Country	Export				Import				Electricity Generation in the Country, Million KWh		Electricity Consumption in the Country, Million KWh	
		Amount of Electricity, Million KWh		Sales Price, cent / KWh		Electricity, Million KWh		Sales Price, cent / KWh					
		1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
1	Russia	137.3	0.7	-	Mutual in payment	2151.0	102.7	-	2.3	14239.4	8097.7	17443.9	8147.5
2	Armenia	597.5	0	-	-	37.3	244.4	-	2.5				
3	Azerbaijan	266.3	143.1	-	Discharge of a previous year's debts	2068.3	86.8	-	Mutual in payment				
4	Turkey	176.4	240.3	Mutual in payment	3.45	125.4	0	Mutual in payment	-				
Total		1177.5	384.1	-	-	4382.0	433.9	-	-	14239.4	8097.7	17443.9	8147.5

COST VALUE OF ELECTRICITY AND TARIFFS
by the state of 1990 and 1999

Table 5

No	HPP	Cost value of generated electricity, Cent / KWh		Cost value of thermal energy, Cent / KWh		TARIFF							
						Percentage of electricity delivered to consumer %		Tariff of Electricity delivered to the End-Users, Cent / KWh		Percentage of electricity delivered to the industry sector and other users, %		Tariff of Electricity delivered to the industry and other users, Cent / KWh	
	THERMAL ELECTRIC STATIONS												
		1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
1	Tbilsresi (150-160 MW) (300 MW)	2.8	3.6 2.59		2.4								
2	Tkvarchelsresi	3.15	4.5	0.5	2.5								
3	Tbiltetsi	4.8											
	HYDRO POWER PLANT												
4	Engurhesi	0.48	1.065										
5	Vardnilhesi-1	0.48	0.585										
6	Vardnilhesi-2	0.48							Tbilisi 4.5				Tbilisi 4.5
7	Vardnilhesi-3	0.48											
8	Vardnilhesi-4	0.48											
9	Khramhesi-1	0.45	0.605										
10	Khramhesi-2	0.45	0.605			20	42.9	2.6		80	57.1	1.3	
11	Jinvalhesi	1.45	0.915										
12	Shaorhesi	0.54	0.79										
13	Tkibulhesi	0.54	0.75						Regions 4.15				Regions 4.15
14	Rionhesi	0.51	0.75										
15	Gumathesi-1	0.51	0.75										
16	Gumathesi-2	0.51	0.75										
17	Vartsikhehesi	0.51	0.625										
18	Lajanurhesi	0.51	0.75										
19	Zahesi	0.82	0.71										
20	Ortachalhesi	0.82	1.25										
21	Atshesi	1.29	1.085										

MAIN CHARACTERISTICS OF THE ELECTRICITY GENERATION PLANTS
by the state of 1990 and 1999

Table 6

½	Quantity	Dimension	1990		1999	
			Designed	Actual	Designed	Actual
1	2	3	4	5	6	7
1	Installed capacity (total value), in which:	MW	4367.1	-	4327.1	-
	- Thermal electric stations	MW	1638.0	-	1718.0	-
	- Large and medium hydro power plants	MW	2593.3	-	2473.3	-
	- Small hydro power plants	MW	135.8	-	135.8	-
2	Generation (total), in which:	Million KWh	20227	14239.4	20316	8097.7
	- Thermal electric stations	Million KWh	9828	6018.3	10308	1633.8
	- Large and medium hydro power plants	Million KWh	9852	7305.2	9461	6197.9
	- Small hydro power plants	Million KWh	547	289.0	547	266.0
	- Departmental Thermal electric station	Million KWh	-	626.9	-	0
3	Installed capacity use factor:					
	- Thermal electric stations	%	68.49	41.94	68.49	10.85
	- Large and medium hydro power plants	%	43.36	32.15	43.66	28.60
4	Specific consumption of fuel					
	- Tbilsresi _ 150 MW Unit	Gram Conditional Fuel/KWh	365	467.09	365	441.4
	- Tbilsresi _ 300 MW Unit	Gram Conditional Fuel/KWh	323		323	
	Tbiltetsi	Gram Conditional Fuel/KWh	370	411.96	370	525.0
5	Consumption	Million KWh	-	17443.9	-	8147.5
6	Import	Million KWh	-	4382.0	-	433.9
7	Export	Million KWh	-	1177.5	-	384.1
8	Share in total consumption:					
	-End-users (population)	%	-	20	-	42.9
	-Industry sector and other users	%	-	80	-	57.1
9	Cost value of electricity:					
	- Tbilsresi _ 150 MW Unit	Cent / KWh	-	1.18	-	3.6
	- Tbilsresi _ 300 MW Unit	Cent / KWh	-		-	2.59
	- Tbiltetsi	Cent / KWh	-	1.33	-	4.5
	- Tkvarchelsresi	Cent / KWh	-	2.03	-	0

SELF-CONSUMPTION OF ELECTRICITY BY THERMAL AND HYDRO POWER PLANTS
by the state of 1990 and 1999

Table 6'

½	HPP	1990								1999							
		Actual generation of electricity	Actual delivery of electricity	Actual value of electricity self-consumption E1		Standards on electricity self-consumption (tentative)		Efficiency Over consumption of electricity for self-use		Actual generation of electricity	Actual delivery of electricity	Actual value of electricity self-consumption E1		Standards on electricity self-consumption (tentative)		Efficiency Over consumption of electricity for self-use	
		Million kWh	Million kWh	Million kWh	%	Million kWh	%	Million kWh	%	Million kWh	Million kWh	Million kWh	%	Million kWh	%	Million kWh	%
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Tbilsresi	5578,1	5210,91	367,19	6,16	357,54	6,86	9,65	102,7	1609,6	1482,17	127,43	7,92	96,58	6,52	30,85	131,95
2	Tkvarchelsresi	96,2	85,48	10,72	11,15	7,7	9	3,03	139,36	24,2	20,76	3,45	14,27	2,42	11,66	1,03	142,67
3	Tbiltetsi	344	308,31	35,69	10,37	20,64	6,69	15,05	172,9	0	0	0	0	0	0	0	0
4	Engurhesi	3579,33	3570,48	8,85	0,25	7,16	0,2	1,69	123,56	2684,1	2676,01	8,09	0,3	5,37	0,2	2,72	150,71
5	Vardnilhesi-1	643,6	641,86	1,74	0,27	1,29	0,2	0,45	135,04	525,4	523,72	1,68	0,32	1,05	0,2	0,63	159,85
6	Vardnilhesi-2	483,5	482,48	1,02	0,51	0,97	0,2	0,05	104,96	217,1	216,5	0,6	0,28	0,43	0,2	0,17	138,25
7	Vardnilhesi-3									207,5	206,73	0,77	0,37	0,42	0,2	0,35	185,06
8	Vardnilhesi-4	361,64	360,66	0,98	0,27	0,72	0,2	0,26	135,27	362	361,04	0,98	0,27	0,72	0,2	0,26	135,36
9	Khramhesi-1	300,6	299,91	0,69	0,51	0,6	0,2	0,09	114,98	167,2	166,62	0,59	0,35	0,33	0,2	0,26	176,95
10	Khramhesi-2									133,8	133,41	0,39	0,29	0,27	0,2	0,12	146,07
11	Jinvalhesi	458,9	457,8	1,1	0,44	0,92	0,2	0,18	119,83	243,8	243,42	0,38	0,15	0,49	0,2	-0,11	77,87
12	Shaorhesi									235,2	234,64	0,56	0,36	0,47	0,2	0,09	120
13	Tkibulhesi																
14	Rionhesi	851,4	849,21	2,19	0,26	1,7	0,2	0,49	128,6	809	805,95	3,05	0,38	1,62	0,2	1,43	188,5
15	Gumathesi-1	357,1	356,75	0,35	0,1	0,71	0,2	-0,36	49,02	344	343,61	0,83	0,24	0,69	0,2	0,14	120,46
16	Gumathesi-2	207,1	206,49	0,61	0,44	0,42	0,2	0,2	146,99	141,6	141,25	0,35	0,25	0,28	0,2	0,07	123,67
17	Vartsikhehesi									68,6	68,44	0,2	0,29	0,14	0,2	0,06	145,99
18	Lajanurhesi	63,1	62,73	0,37	0,59	0,13	0,2	0,24	293,65	58,6	58,25	0,35	0,6	0,12	0,2	0,23	299,15
Total				436,5		407,5		40,02	93,52			162,7		126,4		55,3	129,5

TRENDS OF ACTUAL CAPACITY OF THERMAL AND HYDRO POWER PLANTS IN THE PERIOD OF 1990-1999

Table 7

No	Electricity generation plants	Installed capacity in the period of 1990-1994, MW	Actual capacity, MW					Installed capacity in the period of 1995-1999, MW	Actual capacity, MW				
			1990	1991	1992	1993	1994		1995	1996	1997	1998	1999
THERMAL ELECTRIC STATIONS													
1	Tbilsresi	1400	812.7	733.7	603.1	410	266.7	1700	75.8	158.2	308.3	368.5	393.3
2	Tkvarchelsresi	18	12.9	11.1	6.2	6.9	1.4	18	0.47	3.8	10.4	10.3	9.8
3	Tbiltetsi	220	45.8	21.2	1.7	0	0	220	0	0	0	0	0
Thermal electric stations Total		1638	871.4	766.0	611.0	416.9	268.1	1938 (1718)*	76.27	162.0	318.7	378.8	403.1
HYDRO POWER PLANTS													
4	Engurhesi	1300	1050.0	650.0	700.0	481.2	383.9	1300	555.1	647.5	650.0	752.0	670.7
5	Vardnilhesi-1	220	155.0	158.0	133.0	131.8	60.2	220	56.3	61.0	60.0	68.0	96.3
6	Vardnilhesi-2	40	18.1	-	-	0	0	40	0	0	0	0	0
7	Vardnilhesi-3	40	17.7	-	-	0	0	40	0	0	0	0	0
8	Vardnilhesi-4	40	16.9	-	-	0	0	40	0	0	0	0	0
9	Khramhesi-1	113.45	100.0	75.0	80.0	70.0	50.0	113.45	46.3	63.0	69.9	73.0	86.2
10	Khramhesi-2	110	85.0	33.0	32.0	39.0	47.7	110	27.8	63.2	67.5	76.9	55.8
11	Jinvalhesi	130	65.0	53.4	53.7	55.1	51.3	130	57.4	55.4	60.0	80.0	80.1
12	Shaorhesi	38.4	20.0	20.0	20.0	20.0	17.7	38.4	16.3	18.2	15.0	9.2	23.5
13	Tkibulhesi	80	64.9	42.0	31.5	36.0	29.3	80	23.6	24.5	20.5	27.5	20.0
14	Rionhesi	48	24.0	23.0	22.0	30.0	26.8	49	24.3	35.3	36.0	34.5	23.3
15	Gumat hesi-1	66.8	42.0	33.0	35.0	31.6	11.0	66.8	21.3	32.5	29.8	30.9	36.4
16	Gumat hesi-2	184	111.0	96.9	105.4	108.5	80.3	184	74.6	87.9	113.4	96.0	122.3
17	Vartsikhehesi	111.84	80.0	70.0	56.0	48.2	48.9	111.84	47.2	42.0	47.3	29.6	57.3
18	Lajanur hesi	36.8	54.8	36.3	43.3	39.6	22.3	36.8	16.9	21.2	29.7	23.3	24.3
19	Zahesi	18						18.0	3.5	9.1	12.4	8.6	11.1
20	Ortachalhesi	16	11.0	7.2	7.0	8.1	5.4	16.0	6.0	5.4	10.9	5.4	8.8
Hydro power plants, Total		2593.3	1916.2	1297.8	1318.9	1099.1	834.8	2593.3 (2473.3)**	976.6	1166.2	1222.4	1314.9	1316.1
Small hydro power plants, Total		135.8	98.9	19.5	33.0	1.6	18.2	135.8	20.8	21.3	121.6	29.8	58.8
TOTAL in the country		4367.1	2886.5	2083.3	1962.9	1517.6	1121.1	4667.1 (4327.1)***	1073.67	1349.5	1662.7	1723.5	1778.0
Ratio to the total installed capacity, %		100	66.1	47.7	44.95	34.75	25.67	100	23	28.92	35.63	36.93	38.10

Remarks:

(1718)* Total value of installed capacity for Thermal electric stations except of Tkvarchelsresi installed capacity.

(2473.3)** Total value of installed capacity for Hydro power plants except of Vardnilhesi-2, 3, 4 installed capacities.

(4327.1)*** Total value of installed capacity in the country except of Vardnilhesi-2, 3, 4 and Tkvarchelsresi installed capacities.

TRENDS OF INSTALLED CAPACITY USE FACTOR AT THERMAL AND HYDRO POWER PLANTS IN THE PERIOD OF 1990-1999

Table 8

No	Electricity generation plants	Designed Installed capacity use factor in 1990-1994	Actual Installed capacity use factor, %.					Designed Installed capacity use factor in 1995-1999	Actual Installed capacity use factor, %.				
			1990	1991	1992	1993	1994		1995	1996	1997	1998	1999
THERMAL ELECTRIC STATIONS													
1	Tbilsresi	68.49	45.48	45.26	36.87	22.64	15.77	68.49	4.69	7.30	7.45	11.21	10.80
2	Tkvarchelsresi	68.49	61.00	45.22	28.92	37.03	6.31	68.49	2.60	11.35	5.58	18.20	15.84
3	Tbiltetsi	68.49	17.85	8.25	0.52	-	-	-	-	-	-	-	-
Thermal electric stations, Average value		68.49	41.94	40.29	31.90	19.76	13.55	68.49	4.14	6.51	6.58	10.00	10.85
HYDRO POWER PLANTS													
4	Engurhesi	38.11	31.43	28.06	20.30	25.54	18.20	38.11	27.02	23.89	18.52	27.54	23.56
5	Vardnilhesi-1	36.32	33.39	32.15	28.28	28.02	16.52	36.32	18.86	20.22	20.08	20.59	27.26
6	Vardnilhesi-2	36.24	33.11	-	-	-	-	-	-	-	-	-	-
7	Vardnilhesi-3	36.24	32.22	-	-	-	-	-	-	-	-	-	-
8	Vardnilhesi-4	39.09	32.10	-	-	-	-	-	-	-	-	-	-
9	Khramhesi-1	21.83	19.94	22.3	24.4	28.3	22.7	21.83	14.9	17.4	26.7	22.8	21.83
10	Khramhesi-2	38.39	29.60	33.0	35.2	34.2	24.7	38.39	17.1	28.0	27.2	25.8	21.53
11	Jinvalhesi	43.90	31.75	31.0	31.6	36.2	19.1	43.90	33.2	36.2	45.9	36.2	31.78
12	Shaorhesi	43.99	40.04	28.7	25.2	43.9	26.8	43.99	22.5	23.3	39.2	21.0	49.70
13	Tkibulhesi	23.54	23.67	16.2	24.8	32.2	24.7	23.54	19.5	12.6	22.0	16.6	19.09
14	Rionhesi	77.29	58.78	59.8	65.5	57.1	56.3	77.29	61.6	65.3	66.1	51.5	56.80
15	Gumathesi-1	67.33	36.18	49.5	50.0	46.3	31.9	67.33	30.6	38.9	37.0	33.2	40.19
16	Gumathesi-2	86.85	52.82	43.9	54.9	49.3	34.0	86.85	36.7	39.7	49.3	41.7	50.19
17	Vartsikhehesi	51.54	36.44	34.3	39.8	34.1	30.2	51.54	35.4	30.2	33.6	16.7	35.11
18	Lajanurhesi	65.14	42.77	51.3	57.8	49.0	41.8	65.14	47.2	45.1	49.0	45.6	43.92
19	Zahesi	57.07	43.88	45.1	52.3	28.7	19.4	57.07	22.9	29.4	35.5	29.9	43.50
20	Ortachalhesi	69.20	45.01	39.5	38.3	40.7	36.7	69.20	49.2	42.5	47.2	29.4	41.80
Large Hydro power plants, Average		43.36	32.15	29.90	27.44	29.69	21.21	43.66	26.33	25.65	25.25	26.83	28.66
Small hydro power plants, Average		46.00	24.29	21.02	22.53	24.04	7.90	46.00	18.91	17.99	25.97	22.19	22.36
Average in Country, %		52.87	35.58	33.52	28.96	25.79	17.92	49.69	11.90	17.48	17.52	19.71	19.81

ELECTRIC ENERGY GENERATION IN GEORGIA IN THE PERIOD OF 1985 -1999 (MILLION k Wh)

Table 9

½	Electricity generation plant	Designed generation	Actual generation							Designed generation	Actual generation				
			1985	1989	1990	1991	1992	1993	1994		1995	1996	1997	1998	1999
	THERMAL ELECTRIC STA TION														
1	Tbilsresi	8400,0	6948,9	6138,7	5578,1	5551,0	4521,3	2776,6	1934,3	10200,0	699,2	1087,4	1109,9	1669,5	1609,6
2	Tbiltetsi	108,0	116,2	107,8	96,2	71,3	45,6	58,4	10,0	108,0	4,1	17,9	8,8	28,7	24,2
3	Tkvarchelsresi	1320,0	359,0	84,0	344,0	159,0	10,0	0,0	0,0		0,0	0,0	0,0	0,0	0,0
Total for thermal electric stations		**9828,0**	**7424,1**	**6330,5**	**6018,3**	**5781,3**	**4576,9**	**2835,0**	**1944,3**	**10308,0**	**703,3**	**1105,3**	**1118,7**	**1698,2**	**1633,8**
	HYDRO POWER PLANTS														
1	Engurhesi	4340,0	2882,9	4257,4	3579,3	3195,8	2312,1	2909,0	2072,8	4340,0	3076,8	2721,1	2109,1	3135,8	2684,1
2	Vardnilhesi-1	700,0	706,0	881,3	643,6	619,6	545,0	540,0	318,4	700,0	363,4	389,7	386,9	396,9	525,4
3	Vardnilhesi-2	217,0	154,0	260,9	198,2	222,0	242,8	281,3	226,0	217,0	147,6	172,9	265,5	226,1	217,1
4	Vardnilhesi-3	370,0	247,4	344,2	285,3	318,2	339,1	329,2	237,7	370,0	164,7	269,8	262,2	248,9	207,5
5	Vardnilhesi-4	500,0		337,6	361,6	353,4	360,1	411,9	217,7	500,0	378,3	411,9	522,2	412,5	362,0
6	Khramhesi-1	148,0	45,4	148,7	134,7	92,6	84,9	148,0	90,2	148,0	75,7	78,3	131,9	70,5	167,2
7	Khramhesi-2	165,0	66,6	223,1	165,9	113,6	174,1	226,0	173,0	165,0	136,9	88,0	153,9	116,1	133,8
8	Jinvalhesi	329,0	278,0	232,0	247,2	251,5	275,3	240,2	236,0	329,0	264,2	280,0	283,9	221,1	243,8
9	Shaorhesi	394,0	330,6	306,7	211,7	289,8	292,8	270,8	186,4	394,0	179,0	227,8	216,3	194,4	235,2
10	Tkibulhesi	1400,0	543,6	833,2	851,4	707,4	884,9	794,7	547,3	1400,0	591,2	640,5	794,4	672,9	809,0
11	Rionhesi	505,0	345,3	373,4	357,1	335,9	390,1	333,7	295,8	505,0	347,2	296,1	329,1	164,1	344,0
12	Gumathesi-1	210,0	131,0	140,9	137,9	165,5	186,3	157,9	134,6	210,0	152,3	145,4	157,8	146,9	141,6
13	Gumathesi-2	90,0	67,2	75,0	69,2	71,1	92,5	45,3	30,6	90,0	36,2	46,3	55,9	47,1	68,6
14	Vartsikhehesi	97,0	59,4	65,6	63,1	55,3	53,7	57,1	51,4	97,0	68,9	59,5	66,2	41,2	58,6
Total for large hydro power plants		**9465,0**	**5857,4**	**8480,0**	**7306,2**	**6791,7**	**6233,7**	**6745,1**	**4817,9**	**9465,0**	**9465,0**	**5827,3**	**5735,3**	**6094,5**	**6197,9**
Total for small hydro power plants			386,0	307,0	289,0	250,0	268,0	286,0	94,0		225,0	214,0	309,0	264,0	266,0
Total for hydro power plants			**6243,4**	**8787,0**	**7595,2**	**7041,7**	**6501,7**	**7031,1**	**4911,9**		**6207,4**	**6041,3**	**6044,3**	**6358,5**	**6463,9**
Total for departmental thermal power plants			754,0	707,0	626,9	554,0	438,0	284,0	187,0		171,0	86,0	9,0	0,0	0,0
Total for thermal power plants			**8178,1**	**7037,5**	**6645,2**	**6335,3**	**5014,9**	**3119,0**	**2131,3**		**874,3**	**1191,3**	**1127,7**	**1698,2**	**1633,8**
TOTAL GENERATION IN GEORGIA			**14421,5**	**15824,5**	**14240,4**	**13377,0**	**11516,6**	**10150,1**	**7043,2**		**7081,7**	**7232,6**	**7172,0**	**8056,7**	**8097,7**

MAIN CHARACTERISTICS OF THE BOILERS
by the state of 1990

Table 10

No.		Thermal station location, (city, district)	Installed capacity		Annual generation of thermal energy		Installed capacity use factor		Efficiency of thermal station		Fuel				Date of putting into operation of the station, year
											Annual consumption of fuel		Specific consumption of conventional fuel		
			Designed, MW	Actual, MW	Designed, Thousand MWh	Actual, Thousand MWh	Designed, (K_d)	Actual (K_r)	Designed, %	Actual, %	Natural gas, Million m^3	Mazut, Ton	Designed, Kg/MWh	Actual, Kg/MWh	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		TBILISI													
1	1	Saburtalo	130	64,8	370	207,4	0,57	0,34	89	71	28,9	754	155	173	1962
2	2	Saburtalo	18	10,9	50	34,9	0,57	0,38	89	69	5		155	178	1965
3	3	Samgori	84	67,3	238,2	215,5	0,57	0,51	89	62	26,4	2460	155	164	1966
4	4	Vake	28	25	92	78,4	0,57	0,56	89	62	12,7		155	197	1962
5	5	Didube	28	27	92	79,7	0,57	0,57	89	60	13,4	43	155	205	1962
6	6	Didube	193	127,5	549	408	0,57	0,42	89	75	55	20	155	164	1973
7	7	Samgori	21	20,4	58,1	58,1	0,57	0,55	89	54	10	725	155	225	1966
8	8	Vake	144	68,6	410,3	219,6	0,57	0,31	89	67	31,8	1450	155	183	1962
9	9	Mtatsminda	72	22	200,5	70,4	0,56	0,2	89	67	7,3	3065	155	183	1964
10	10	Saburtalo	74	45,9	211,7	146,8	0,57	0,4	89	67	20	2080	155	183	1965
11	12	Nadzaladevi	98	77,2	278	247,2	0,57	0,5	89	70	35	600	155	176	1965
12	13	Saburtalo	86	41,2	211,7	131,8	0,57	0,3	89	68	17,5	2030	155	181	1965
13	14	Vake	174	63	513,5	201,7	0,57	0,2	89	75	25	815	155	164	1979
14	16	Samgori	70	33,2	198,5	106,3	0,57	0,3	89	66	16,2		155	187	1964
15	17	Gldani	254	158,8	721,1	508,2	0,57	0,4	89	66	77,3		155	187	1972
16	18	Saburtalo	154	83,7	436,7	267,8	0,57	0,35	89	58	39	7010	155	211	1968
17	19	Vake	122	79,8	347,4	255,4	0,57	0,42	89	76	35	2870	155	161	1973
18	20	Isani	177	76,7	502,9	245,5	0,57	0,28	89	73	33	890	155	167	1968
19	21	Nadzaladevi	188	67,6	536,1	216,4	0,57	0,28	89	74	28	1600	155	166	1972
20	22	Samgori	119	64,2	337,5	205,4	0,57	0,35	89	75	23,6	3800	155	164	1973
21	23	Krtsanisi	119	32,2	337,5	103	0,57	0,18	89	74	13,8	250	155	166	1978
22	24	Isani	119	52	337,5	166,6	0,57	0,28	89	58	27,5	1300	155	211	1971
23	25	Didube	291,4	108,6	830,5	347,5	0,57	0,24	89	71	30,8	17380	155	173	1973
24	26	Chugureti	14	11	38,8	35,2	0,57	0,5	89	71	5		155	173	1973
25	27	Mtatsminda	18,2	9,1	51,8	29,1	0,57	0,41	89	73	4	15	155	167	1975
26	28	Vake	112	71,5	317,5	228,8	0,57	0,41	89	73	25	6000	155	167	1966
27	29	Samgori	14	8,9	38,8	28,3	0,56	0,4	89	70	4,1		155	176	1978
28	30	Isani	32,2	28	92,7	89,6	0,57	0,54	89	71	12,4	320	155	173	1962
29	31	Samgori	49	26,8	139	85,8	0,57	0,35	89	71	12,1	125	155	173	1976
30	32	Saburtalo	70,4	27,7	201,8	88,7	0,57	0,25	89	73	11,8	429	155	167	1981
31	33	Krtsanisi	17,2	11,3	49,7	36,1	0,57	0,42	89	75	4,6	193	155	164	1975
32	34	Nadzaladevi	7	6	19,8	19,2	0,57	0,55	87	60	3,3		155	205	1974
33	35	Gldani	20	9	55	28,7	0,57	0,29	87	59	4,8	150	155	208	1972
34	36	Krtsanisi	118	56,6	347,4	181,2	0,57	0,31	89	74	21,9	2663	155	166	1974
35	37	Krtsanisi	5,1	1,7	14,2	5,5	0,57	0,21	87	51	1,1		155	242	1964
36	39	Vake	4,9	7,2	15,8	13,5	0,57	0,55	80	72	1,8	75	155	172	1985
37	40	Saburtalo	21	12,2	58,1	39,2	0,57	0,37	87	63	6,3		155	194	1966

Cont. Table 10

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
38	41	Samgori	130	64,8	370	207,4	0,57	0,34	89	71	28,9	754	155	173	1962
39	42	Samgori	18	10,9	50	34,9	0,57	0,38	89	69	5		155	178	1965
40	43	Nadzaladevi	84	67,3	238,2	215,5	0,57	0,51	89	62	26,4	2460	155	164	1966
41	44	Gldani	28	25	92	78,4	0,57	0,56	89	62	12,7		155	197	1962
42	45	Isani	28	27	92	79,7	0,57	0,57	89	60	13,4	43	155	205	1962
43	46	Isani	193	127,5	549	408	0,57	0,42	89	75	55	20	155	164	1973
44	47	Vake	21	20,4	58,1	58,1	0,57	0,55	89	54	10	725	155	225	1966
45	48	Didi digomi	144	68,6	410,3	219,6	0,57	0,31	89	67	31,8	1450	155	183	1962
Total in Tbilisi			4328	2213	12353,4	7057,8			88,58	68,38	954	63439			
46	1	Batumi	71,9	70	190	224	0,56	0.39	87	73	0	28350	155	167	1967
47	2	Batumi	20,9		55,8		0,56		88	73					1968
48	3	Batumi	20,9		55,8		0,56		88	73					1970
49	1	Kutaisi	156,8	230	403,8	736	0,54	0.42	85	81	21	65500	155	164	1968
50	2	Kutaisi	167,5		431,4		0,54		85	81					1970
51	roup boils	Kutaisi	26,7		32,68		0,54		85	81					
52	1	Rustavi	174,5	258	513,5	828	0,54	0.52	85	77	32,6	69800	155	159	1965
53	2	Rustavi	123,3		362,9		0,54		85	77					1970
54	3	Rustavi	17,4		48,5		0,54		85	77					1976
55	1	Telavi	52,3	50	148,9	160	0,56	0.4	87	77	21		155	189	1972
56	2	Telavi	27,9		79,4		0,56		87	77					1978
57	1	Zestaphoni	20,9	13	54	48,6	0,54	0,4	85	70	6		155	176	1977
58	1500	The Rest Cities of Georgia	348,9	288	969,7	921,6	0,54	0,52	85	70	63,4	63480	155	176	
Grand Total			5559	3122	15699,78	9975,8	0,56	0,37			1098	617869			

MAIN CHARACTERISTICS OF ELECTRICITY TRANSMISSION LINES IN GEORGIA
by the state of 1990 and 1999

Table 1.1

No.	Electricity transmission line	Date of putting into operation, year	Wire cross-section, mm^2		Number of aluminum threads		Number of the steel threads		Permissible value of current strength, A		Number of phase split		Number of circuits (electric chains)		Wire length, km	
1	2	3	4		5		6		7		8		9		10	
			1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
500 KV ELECTRICITY TRANSMISSION LINES																
1	Kavkasioni	1984	400	400	30	30	19	19	865	865	3	3	1	1	102,3	102,3
2	Imereti	1978	400	400	30	30	19	19	865	865	3	3	1	1	127,77	127,77
3	Kartli-II	1968	400	400	30	30	19	19	0	0	3	3	1	1	165	165
4	Kartli-I	1968	400	400	30	30	19	19	865	865	3	3	1	1	91,91	91,91
5	Mukhrani	1987	300		30		19		865		3		1		91,91	56,91
NUMBER OF THE ELECTRIC TRANSMISSION LINES _5													TOTAL		578,89	543,89
330 KV ELECTRICITY TRANSMISSION LINES																
1	Gardabani	1958	300	300	28	28	7	7			1	1	1	1	21	21
NUMBER OF THE ELECTRIC TRANSMISSION LINES _1													TOTAL		21	21
220 KV ELECTRICITY TRANSMISSION LINES																
1	Achara	1979	400	400	28	28	19	19	835	835	1	1	1	1	12	12
2	Paliastomi-I	1973	400	400	28	28	19	19	835	835	1	1	1	1	98	98
3	Paliastomi-II	1981	400	400	28	28	19	19	835	835	1	1	1	1	149,6	149,6
4	Kolxida -I	1956	300	300	28	28	7	7	690	690	1	1	1	1	66,7	66,7
5	Kolxida -II	1956	300	300	28	28	7	7	690	690	1	1	1	1	47	47
6	Kolxida-II a	1956	300	300	28	28	7	7	690	690	1	1	1	1	20,1	20,1
7	Kolxida -III	1956	300	300	28	28	7	7	690	690	1	1	1	1	31,5	31,5
8	Iveria-I	1964	400	400	28	28	19	19	835	835	1	1	1	1	61,8	61,8
9	Iveria-II	1964	400	400	28	28	19	19	835	835	1	1	1	1	78,2	78,2
10	Salxino	1969	400	400	28	28	19	19	835	835	1	1	1	1	38,4	38,4
11	Egrisi-I,-II	1977	500	500	42	42	7	7	945	945	1	1	2	2	11,5	11,5
12	Sataflia	1990	480	480					835	835	1	1	1	1	26,8	26,8
13	Derchi	1960	480	480					835	835	1	1	1	1	47,8	47,8
14	Ajameti-I	1959	400	400	28	28	19	19	835	835	1	1	1	1	26	13
15	Ajameti-II	1959	400	400	28	28	19	19	835	835	1	1	1	1	21,5	21,5
16	Fero-I,-II	1979	400	400	28	28	19	19	835	835	1	1	2	2	7,5	7,5
17	Surami	1959	400	400	28	28	19	19	835	835	1	1	1	1	71,8	71,8
18	Urbnisi	1959	480	480					835	835	1	1	1	1	42,2	42,2
19	Liaxvi	1959	400	400	28	28	19	19	835	835	1	1	1	1	56,6	56,6
20	Lomisi	1985	300	300	28	28	7	7	690	690	1	1	1	1	40,5	40,5
21	Aragvi	1959	400	400	28	28	19	19	835	835	1	1	1	1	31,7	31,7
22	Didgori -I,-II	1984	300	300	28	28	7	7	690	690	1	1	1	1	19,05	19,05
23	Koda -I	1979	400	400	28	28	19	19	835	835	1	1	1	1	33,3	33,3
24	Koda -II	1979	400	400	28	28	19	19	835	835	1	1	1	1	56,5	56,5
25	Lomtagora	1979	400	400	28	28	19	19	835	835	1	1	1	1	23,2	23,2
26	Kukia	1959	480	480					835	835	1	1	1	1	17,7	17,7
27	Navtlugi	1958	300	300	28	28	7	7	690	690	1	1	1	1	36,3	36,3
28	Varketili	1966	500	500	42	42	7	7	945	945	1	1	1	1	48,6	48,6
29	Veli-I	1976	500	500	42	42	7	7	945	945	1	1	1	1	26	26
30	Veli-II	1974	500	500	42	42	7	7	945	945	1	1	1	1	21,5	21,5

Cont. Table 11

1	2	3	4		5		6		7		8		9		10	
31	Manavi	1970	500	500	42	42	7	7	945	945	1	1	1	1	75	75
32	Alaverdi	1960	300	300	28	28	7	7	690	690	1	1	1	1	38,9	38,9
33	Algeti	1963	400	400	28	28	19	19	835	835	1	1	1	1	65,2	65,2
NUMBER OF THE ELECTRICITY TRANSMISSION LINES _33													TOTAL		1448,45	1435,45
110 KV ELECTRICITY TRANSMISSION LINES																
1	Types, Sections and total length Σl110=4727.75km of 110kV ELECTRICITY TRANSMISSION LINES		50	50	6	6	7	7	220	220	1	1	1	1	29	29
2			70	0	6	0	7	0	275	0	1		1	0	217,5	157,7
3		0	95	95	28	28	7	7	335	335	1	1	1	1	117,6	117,6
4			120	0	28	0	7	0	380	0	1		1	0	1640,05	1228,8
5			150	0	28	0	7	0	445	0	1		1	0	1871,72	1719,22
6			185	0	28	0	7	0	535	0	1		1	0	489,2	418,5
7			240	0	28	0	7	0	610	0	1		1	0	283,08	164,38
8			300	300	28	28	7	7	690	690	1	1	1	1	26,1	26,1
9			400	400	28	28	19	19	835	835	1	1	1	1	50,5	50,5
NUMBER OF THE ELECTRICITY TRANSMISSION LINES_319													TOTAL		4724,75	3911,8
35 KV ELECTRICITY TRANSMISSION LINES																
1	Types, Sections and total length Σl35=3643.4km of 35 kV ELECTRICITY TRANSMISSION LINES		35	35	6	6	3	3	170	170	1	1	1	1	71,4	71,4
2			50	0	6	0	7	0	220	0	1		1	0	346,25	251,55
3			70	0	6	0	7	0	275	0	1		1	0	670,52	567,22
4			95	0	28	0	7	0	335	0	1		1	0	1395,44	1249,64
5			120	0	28	0	7	0	380	0	1		1	0	774,38	645,68
6			150	0	28	0	7	0	445	0	1		1	0	316,51	263,61
7			185	185	28	28	7	7	535	535	1	1	1	1	68,9	68,9
NUMBER OF THE ELECTRICITY TRANSMISSION LINES_333													TOTAL		3643,4	3118
10; 6 AND 0.4 KV ELECTRICITY TRANSMISSION LINES																
1	LENGTH of 10; 6 and 0.4kV ELECTRICITY TRANSMISSION LINES Σl10+Σl6+Σl0.4 >12933															

MAIN CHARACTERISTICS OF SUBSTATIONS AND REACTORS OF GEORGIA ENERGY SYSTEM
by the state of 1990 and 1999

Table 12

No.	Substations								Reactors			
	Name of substation	Date of putting into operation, year	Number of transformers		Nominal capacity, MVA		Maximum operational voltage, A		Number of reactors		Nominal capacity, MVAR	
1	2	3	4		5		6		7		8	
			1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
						500 kV						
1	D. Zestafoni- 500	1965	2	2	2x200	2x200	252	252	3	3	60	60
		1965	3	3	3x167	3x167	525	525	3	3	60	60
2	Ksani-500	1984	2	2	2x125	2x125	252	252	3	3	60	60
		1984	3	3	3x167	3x167	525	525	3	3	60	60
Number of 500 kV substations_2												
						330 kV						
1	Tbilsresi-220	1963	3	3	3x133	3x133	363	363	0	0	0	0
						220 kV						
1	Batumi-220	1975	2	2	2x125	2x125	252	252	0	0	0	0
2	Menji-220	1970	2	2	2x63	2x63	252	252	0	0	0	0
3	Zugdidi-220	1986	2	2	2x63	2x63	252	252	0	0	0	0
4	D.Kutaisi-220	1959	3	3	3x40	3x40	252	252	0	0	0	0
5	Soxumi-220	1977	2	0	2x125	0	252	252	0	0	0	0
6	Bzifi -220	1964	2	2	2x125	2x125	252	252	0	0	0	0
7	Tskaltubo-220	1989	2	2	2x125	2x125	252	252	0	0	0	0
8	Xashuri - 220	1973	2	2	2x125	2x125	252	252	0	0	0	0
9	Gori-220	1965	2	1	1x60	1x125	252	252	0	0	0	0
10	Gldani -220	1966	1	2	2x125	2x125	252	252	0	0	0	0
11	Lisi-220	1978	2	2	2x125	2x125	252	252	0	1	0	1,6
12	Marneuli-220	1980	2	2	2x125	2x125	252	252	0	0	0	0
13	D.Navtlugi - 220	1986	2	2	2x125	2x125	252	252	0	0	0	0
14	Rustavi - 220	1980	1	1	1x200	1x200	252	252	0	2	0	1,5
15	Gurjaani-220	1982	2	2	2x125	2x125	252	252	0	0	0	0
16	Didu be-220	1980	2	2	2x125	2x125	252	252	0	0	0	0
Number of 220 kV substations_16												
						110 kV						
Number of 110 kV substations _139												
						35 kV						
Number of 35 kV substations_235												
						10 ; 6 and 0.4 kV						

CHARACTERISTICS OF MAIN UNITS OF OUTDOOR DISTRIBUTION EQUIPMENT AT THE THERMAL AND HYDRO POWER PLANTS

by the state of 1990 and 1999

Table 13

	Name of power plant	Date of putting into operation, year	POWER TRANSFORMER						
			Bas -bars by voltage levels	Number of transformers		Nominal ca pacity, MVA		Tention, KV	
				1990	1999	1990	1999	1990	1999
1	Tbilsresi	1963	110	2	2	180	180	110/18	110/18
			110	3	3	125	125	220/ 110	220/110
			220	3	3	133	133	330/ 220	330/220
			220	6	6	180	180	220/ 18	220/18
			500	2	2	400	400	500/ 20	500/20
			500	3	3	267	267	500/ 220	500/220
2	Tbiltetsi	1939	35	2	2	25	25	35/ 6	35/6
3	Tkvarchelsresi	1938	35	2	0	5,6	0	35/ 6	-
			110	2	0	180	0	110/ 35	-
			220	3	0	125	0	220/ 110	-
4	Engurhesi	1978	110	1	1	32	32	220/ 110/10	220/110/10
			220	3	3	167	167	500/ 220/10	500/220/10
			500	5	5	400	400	500/ 16	500/16
5	Vardnilhesi-1	1971	110	1	1	200	200	220/ 110/13,8	220/110/13,8
			220	2	2	125	125	220/ 13,8	220/13,8
6	Vardnilhesi-2	1971	110	2	0	25	0	110/ 3,5	-
7	Vardnilhesi-3	1971	110	2	0	25	0	110/ 3,5	-
8	Vardnilhesi-4	1971	110	2	0	25	0	110/ 3,5	-
9	Khramhesi-1	1947	110	2	2	80	80	110/ 10,5	110/10,5
			110	3	3	16	16	110/ 10,5	110/10,5
10	Khramhesi-2	1963	110	3	3	60	60	220/ 110/10,5	220/110/10,5
			220	3	3	40	40	220/ 110/10,5	220/110/10,5
11	Jinvalhesi	1985	110	1	1	63	63	110/ 10,5	110/10,5
			220	2	2	80	80	220/ 10,5	220/10,5
12	Shaorhesi	1955	35	1	1	40	40	110/ /35/10	110//35/10
			110	1	1	24	24	110/ /35/10	110//35/10
13	Tkibulhesi	1956	110	1	1	60	60	110/ 10,5	110/10,5
			110	1	1	80	80	110/ 10,5	110/10,5
14	Rionhesi	1933	35	2	2	25	25	110/ 35/6,6	110/35/6,6
			110	2	2	16	16	110/ 6,6	110/6,6
15	Gumathesi -1	1958	35	1	0	40	40	110/ 35/6,3	110/35/6,3
			110	1	0	40	40	110/ 35/6,3	110/35/6,3
16	Gumathesi -2	1956	110	1	1	31,5	31,5	110/ 6,3	110/6,3
17	Vartsikhehesi	1976	110	4	4	80	80	110/ 10,5	110/10,5
18	Lajanurhesi	1960	35	1	1	10	10	220/ 110/35	220/110/35
			110	1	1	10	10	220/ 110/35	220/110/35
			220	2	2	80	80	220/ 10,5	220/10,5
19	Zahesi	1927	35	4	4	5,6	5,6	35/ 6,4	35/6,4
			110	6	6	5	5	110/ 35/6,6	110/35/6,6
20	Ortachalhesi	1954	35	1	1	63	63	110/ 35/6,3	110/35/6,3
			110	1	1	63	63	110/ 35/6,3	110/35/6,3
21	Atshesi	1937	35	1	1	10	10	110/ 35/6,6	110/35/6,6
			110	1	1	16	16	110/ 35/6,6	110/35/6,6

LOSSES IN ELECTRICITY TRANSMISSION LINES

Table 14

Electricity delivered to grid, Million kWh		Voltage of transmission lines, KV	Transmitted Electricity, Million kWh		Electricity transmission lines				Substations and Open Distribution Equipments										Commercial losses, Million kWh		Total losses			
					Losses on load, Million kWh		Losses on crown, Million kWh		Transformer				Electricity losses on self consumption, Million kWh		Electricity losses in gauge equipment, Million kWh		Losses in reactors, Million kWh				Absolute, Million kWh		Relative (from the electricity delivered to grid), %	
									Losses on load, Million kWh		Idling losses, Million kWh													
1990	1999		1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
16709.1	7870.6	500	7525,5	3296	83	60	33	14,3	28	9	26,8	12	2,2	2	0,1	0,2	0,3	0,5			173,4	98	1,04	1,25
		330	2068,3	145,4	8	2,6	1	0,1	6	6,3	2,8	3,3									17,8	12,3	0,11	0,13
		220	12736,6	5536,3	278	157,4	21	16,6	73	35	56	36	3,3	3	14,6	0,5	0,7	0,5			446,6	249	2,67	3,16
		110	14685,8	7008,7	388	195			136	64	114	66	7,3	6,5	15,4	2	4,3	3,5		80	665	417	3,98	5,3
		35			86	45			38	14	35	14	1,4	1	0,4	0,7	0,7	0,5		23,8	161,5	99	0,97	1,26
		10	2425,7	740	491,5	20			60	5,2	55	5	1,3	0,3	0,2					6,5	608	37	3,64	0,49
		6																		5				
		0.4			466,1	18									0,5						466,6	23	2,79	0,29
Total Losses					1800,6	498			**341**	133,5	**289,6**	136,3			31,1						2538,9	935,3	15,2	11,8

Normative technical electricity losses in Georgia -1999 (%)

Table 15

No	*Voltage kV*	*Sakrusenergo*	*Electricity transmission*	*Telasi*	*Companies (excluding Dusheti)*	*Dusheti*	*TOTAL*
1	500	1,1	0,3				1,4
2	220	0,1	3,4				3,5
3	110		3,9	0,65		0,02	4,57
4	35		0,8	0,25		0,01	1,06
5	10-6			0,96	1,15	0,03	2,14
6	0,4			1,42	1,7	0,06	3,18
TOTAL		**1,2**	**8,4**	**3,28**	**2,85**	**0,12**	**15,85**

MAIN CHARACTERISTICS OF THERMAL POWER DISTRIBUTION NETWORKS
by the state of 1990

Table 16

No.		Boiler (city, district)	Heat supply zone, Km^2	Specific heat load (density), MW/Km^2	Total length o heat network, km	Type of heat network construction			Number of Central heating substations	Number of Pumping stations	Extent of damage				Heat Losses	
						Underground		Over groun d,			Heat supply network		Central heating Substations, %	Pumping stations, %	Absolute annual Thousand, MWh	Relative, %
						With canal %	Without canal %				Pipeline %	Insulation %				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
		TBILISI														
1	1	Saburtalo	1	54	34.5	73	25	2	4	0	75	75	20	0	41.48	20
2	2	Saburtalo	0.25	38	4.35	100	0	0	1	0	95	97	30	0	5.23	15
3	3	Samgori	1.8	28	38.13	100	0	0	4	1	43	50	20	5	21.55	10
4	4	Vake	0.6	46	17.23	70	30	0	3	1	57	65	20	0	11.76	15
5	5	Didube	0.35	86	17.6	70	30	0	7	1	75	80	30	5	15.94	20
6	6	Didube	2.25	43	51	60	25	15	14	0	45	65	10	0	122.4	30
7	7	Samgori	0.85	22	12	100	0	0	4	0	87	90	50	0	7.55	13
8	8	Vake	1.15	53	38.1	70	30	0	8	1	72	75	10	5	26.35	12
9	9	Mtatsminda	0.8	23	39	70	30	0	0	0	60	65	0	0	10.56	15
10	10	Saburtalo	0.72	55	24	70	30	0	8	0	76	80	10	0	22.02	15
11	12	Nadzaladevi	2.65	24	42	70	30	0	7	1	60	65	5	5	49.44	20
12	13	Saburtalo	0.85	42	18.4	100	0	0	8	0	77	79	10	0	19.77	15
13	14	Vake	1	41	27	60	25	15	6	0	80	85	10	0	30.26	15
14	16	Samgori	1.76	16	11	70	0	30	1	0	45	47	5	0	15.94	15
15	17	Gldani	3	46	55.7	80	0	20	15	1	75	80	10	5	76.23	15
16	18	Saburtalo	1.7	43	44.7	75	25	0	15	1	80	85	16	5	34.81	13
17	19	Vake	1,15	60	36	50	35	15	7	1	76	80	15	5	38,31	15
18	20	Isani	2.1	31	56	80	20	0	15	1	60	65	5	5	36.83	15
19	21	Nadzaladevi	1.5	39	33	80	20	0	6	0	66	68	10	0	32.46	15
20	22	Samgori	6,8	7	38	90	0	10	6	0	54	57	15	0	41,08	20
21	23	Krtsanisi	2	13	11	80	20	0	3	1	60	70	20	10	15.45	15
22	24	Isani	2	22	26	80	20	0	19	0	70	75	30	0	24.99	15
23	25	Didube	2.3	39	58	80	20	0	4	0	47	45	15	0	69.5	20
24	26	Chugureti	0.3	33	5	80	20	0	0	0	80	85	0	0	3.52	10
25	27	Mtatsminda	0.2	35	8	80	20	0	0	0	80	80	0	0	4.36	15
26	28	Vake	1.5	41	42	70	20	10	12	0	70	75	20	0	34.32	15
27	29	Samgori	0.4	19	8	100	0	0	6	0	75	75	30	0	4.25	15
28	30	Isani	1	25	9	100	0	0	8	0	52	55	10	0	11.65	13
29	31	Samgori	0.9	26	21	100	0	0	6	0	40	50	5	0	11.15	13
30	32	Saburtalo	0.9	26	20	100	0	0	10	1	50	52	20	5	13.31	15
31	33	Krtsanisi	2.36	26	4	100	0	0	1	0	60	60	25	0	3.61	10
32	34	Nadzaladevi	0.2	33	3	80	20	0	2	0	70	75	20	0	2.88	15
33	35	Gldani	0.18	43	5.4	40	0	0	0	0	40	40	0	0	4.31	15
34	36	Krtsanisi	2.06	22	42	100	0	0	3	1	60	55	20	5	36.24	20
35	37	Krtsanisi	0.04	34	5.7	0	100	0	1	0	75	75	30	0	1.1	20
36	39	Vake	0.05	116	6	65	20	15	0	0	63	68	0	0	1.35	10
37	40	Saburtalo	0.52	19	11	100	0	0	0	0	100	100	0	0	7.84	20
38	41	Samgori	0.5	56	18.7	100	0	0	10	0	60	65	10	0	15.53	15
39	42	Samgori	0.02	54	0.6	100	0	0	0	0	30	30	0	0	0.7	20
40	43	Nadzaladevi	2	45	30	75	25	0	15	0	70	75	20	0	54.72	16
41	44	Gldani	1,3	62	23	95	3	2	9	0	45	55	5	0	28,58	10
42	45	Isani	1.3	45	29	80	20	0	8	0	0	0	5	0	64.45	27
43	46	Isani	2.1	44	45	80	20	0	12	0	0	0	5	0	66.47	18
44	47	Vake	0.6	53	27	80	20	0	4	0	0	0	5	0	17.91	15

Cont. Table 16

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
45	48	Didi digomi	1.38	35	50	90	5	5	8	0	0	0	5	0	33.02	20
		Total in Thilisi	52.4		1142				258	12					1191.18	
46	-	Batumi	1,7	25	40	90	0	10	0	0	35	45	0	0	44,8	20
47	-	Kutaisi	0.9	20	25	95	0	5	0	0	25	25	0	0	32	20
48	-	Rustavi	3.3	36	105	98	0	2	1	0	30	35	10	0	147.2	20
49	-	Telavi	4.2	35	100	95	0	5	0	0	20	25	0	0	165.6	20
50	-	Zestaphoni	0.32	24	14	100	0	0	0	0	25	30	0	0	9.7	20
51		Remaining Cities of Georgia		0	175	90	0	10	0	0	50	50	0	0	184,3	20
		Grand Total	62.82		1601				259	12					1590.48	

ENERGY CONSUMPTION BY RESIDENTIAL SECTOR

Table 17

No.	Long-lived appliances		*TV sets*		*Audio facilities*		*Refrigerators*		*Washing machines*		*Electric stoves*		*Vacuum cleaners*		*Iron*		*PC*		*Electric sewing-machines*		*Water heating tanks*	
			1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
1	Number of families in the country (thousand)		1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
2	Share of appliance owner's families in total number of families (%)		90	96	16	28	85	79	60	62	0	90	60	60	98	99	0	0,8	2	3	0	15
3	Quantity (thousand units)		1080	1152	192	336	1020	948	720	744	0	1080	720	720	1176	1188	0	10	24	36	0	180
4	Validity index	Properly functioning (Thousand units)	972	1025	178	323	918	758	547	670	0	972	648	648	1117	1164	0	9	20	31	0	173
		Malfunctioning (Thousand units)	108	127	14	13	102	190	173	74	0	108	72	72	59	24	0	1	4	5	0	7
5	Average age (years)		9,5	14	3	6	12	17	8	15	0	2	5	6	5	5	0	5	7	18	0	7
6	Per unit average capacity (kW)		0,2	0,1	0,1	0,05	0,2	0,2	0,2	0,3	0	1	0,6	0,6	1	1	0	0,5	0,1	0,1	0	1,5
7	Average operating hours per day (hours)		7	4	4	4	10	4	0,5	2	0	4	0,5	1	0,5	0,5	0	4	1	1	0	5
8	Annual consumption of electricity (thousand kWh)		551880	168192	28032	24528	744600	276816	26280	162936	0	1576800	78840	157680	214620	216810	0	7300	876	1314	0	492750
9	Efficiency		0,75	0,8	0,8	0,8	0,7	0,7	0,55	0,55	0	0,7	0,8	0,8	0,75	0,75	0	0,8	0,6	0,6	0	0,85
10	Power factor		0,9	0,6	0,85	0,6	0,55	0,55	0,65	0,65	0	1	0,75	0,75	1	1	0	0,6	0,7	0,7	0	1
11	Reactive energy generated by the system	Starting reactive (thousand kWh)	267107,5	0	17351,8	0	1130298	420206,7	122885,3	190472,2	0	0	69458	138916,1	0	0	0	0	894,4	1341, 59	0	0
		Alteration reactive (thousand kWh)	0	224199,8	0	32695,8	0	0	0	0	0	0	0	0	0	0	0	9341,7	0	0	0	0
12	Energy losses in end-users (thousand kWh)		137970	33638,4	5606,4	4905,6	223380	83044,5	11826	73321,2	0	473040	15768	31536	53655	54202,5	0	1460	350,4	525,6	0	73912,5
13	Additional losses in system from reactive energy generation (%)		10,25	60,1	19,94	60,1	66,48	66,48	53,19	53,19	0	0	37,67	37,67	0	0	0	60,1	45,7	45,7	0	0

ELECTRICITY CONSUMPTION BY THE RESIDENTIAL AND MUNICIPAL SECTORS & EFFICIENCY

Table 18

	Parameters \ End-users		INDOOR LIGHTING						STREET LIGHTING						ELEVATORS					
			TBILISI		REST OF GEORGIA		TOTAL		TBILISI		REST OF GEORGIA		TOTAL		TBILISI		REST OF GEORGIA		TOTAL	
			1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
1	Number of families (thousand)		350	350	850	850	1200	1200												
	Number of streets								2000	2000	1000	1000	3000	3000						
	Number of elevators (thousand)														8,5	2,5	4	0,4	12,5	2,9
2	Average amount of incandescent bulbs (thousand)		1400	1400	3400	3400	4800	4800												
	Number of fluorescent lamps (thousand)								56	11,2	25	5	81	16,2	0	0	0	0	0	0
3	Average capacity of bulbs(kWh)		0,1	0,1	0,1	0,1														
	Per unit average capacity (kWh)								0,32	0,32	0,32	0,32			4	4	4	4		
4	Mean operating hours per day (hours)		6	4	6	1	12	5	12,5	5	12,5	1,5	25	6,5	4	1	4	1	8	2
5	Annual consumption of electricity (thousand kWh)		306600	204400	744600	124100	1051200	328500	78489,6	6540,8	35040	2920	113529,6	9460,8	49640	3650	23360	584	73000	4234
6	Type of bulbs	Incandescent	exists	exists	exists	exists			does not exist	does not exist	does not exist	does not exist			does not exist	does not exist	does not exist	does not exist		
		Luminescent lamp,	does not exist	does not exist	does not exist	does not exist			does not exist	does not exist	does not exist	does not exist			does not exist	does not exist	does not exist	does not exist		
		Fluorescent lamp	does not exist	does not exist	does not exist	does not exist			exists	exists	exists	exists			does not exist	does not exist	does not exist	does not exist		
7	Efficiency	Bulbs and lamps	0,1	0,1	0,1	0,1			0,2	0,2	0,2	0,2			0	0	0	0		
		Starting devices	0	0	0	0			0,8	0,8	0,8	0,8			0	0	0	0		
		Elevators	0	0	0	0			0	0	0	0			0,8	0,8	0,8	0,8		
8	Power factor		1	1	1	1			0,5	0,5	0,5	0,5			0,7	0,7	0,7	0,7		
9	Illumination (lum/W)		10	10	10	10			50	50	50	50			0	0	0	0		
10	Reactive energy generated in system (thousand kWh)		0	0	0	0	0	0	135943	11328,6	60689,3	50057,4	196632,3	61386	50682,4	3726,65	23850,6	596,26	74533	4322,91
11	Energy consumption	Bulbs and lamps (thousand kWh)	275940	183960	670140	111690	946080	295650	62791,8	5232,6	28032	2326	90823,8	7558,6	0	0	0	0	0	0
		Starting devices (thousand kWh)	0	0	0	0	0	0	15697,9	1308,16	7008	584	22705,9	1892,16	0	0	0	0	0	0
		Elevators (thousand kWh)	0	0	0	0	0	0	0	0	0	0	0	0	9928	730	4672	116,8	14600	846,8
12	Types of electricity supply network	Air-lines (Thousand km)							2.0	2.0	0	0	2.0	2.0						
		Cablelines (Thousand km)							0.97	0.97	0	0	0.97	0.97						

URBAN TRANSPORT – MAIN CHARACTERISTIC S OF TROLLEYBUSES AN D TRAMWAY SUBSTATIONS' UNITS

(1990 and 1999)

Table 19-1

City	Traction substation	Electricity delivered to the traction substation		TRANSFORMERS: Number		Nominal capacity, KVA		Date of putting into operation Year	Expire of lifetime, Year	Efficiency: Designed		Efficiency: Actual	
		1990	1999	1990	1999	1990	1999			1990	1999	1990	1999
		TROLLEYBUSTRACTION SUBSTATIONS											
TBILISI	Avlabari	1458	414	3	3	685	685	1968	1991	0,98	0,98	0,921	0,872
	Sanapiro	1965	558	2	2	1385	1385	1970	1993	0,98	0,98	0,921	0,901
	Saburtalo-I	1944	552	4	4	685	685	1968	1991	0,98	0,98	0,921	0,872
	Saburtalo –II	2948	837	3	3	1385	1385	1956	1979	0,98	0,98	0,872	0,862
	Tsentraluri	2948	837	3	3	1385	1385	1968	1991	0,98	0,98	0,921	0,901
	Saburtalo	1458	414	3	3	685	685	1973	1996	0,98	0,98	0,921	0,901
	Delisi	2948	837	3	3	1385	1385	1974	1997	0,98	0,98	0,921	0,901
	Digomi – I	972	276	2	2	685	685	1979	2002	0,98	0,98	0,941	0,921
	Digomi – II	972		2	0	692	0	1979	2002	0,98	0	0,941	
	Varketili	982		2	0	685	0	1974	1997	0,98	0	0,921	
	Tseronisi	972	276	2	2	685	685	1973	1996	0,98	0,98	0,921	0,901
	CENTRAL TRACTION SUBSTATIONS												
	Farekhi	972	276	2	2	685	685	1961	1984	0,98	0,98	0,901	0,862
	Ortachala	972	276	2	2	685	685	1967	1990	0,98	0,98	0,921	0,872
	Navtlugi	1458	414	3	3	685	685	1967	1990	0,98	0,98	0,921	0,872
	Javakheti	972	276	2	2	685	685	1973	1996	0,98	0,98	0,921	0,901
	Didube	1458	414	3	3	685	685	1968	1991	0,98	0,98	0,921	0,872
	TRAMWAY TRACTION SUBSTATIONS												
	Depo-avchala	982	279	2	2	692	692	1984	2007	0,98	0,98	0,95	0,841
	Grmagele	1458	414	3	3	685	685	1961	1984	0,98	0,98	0,901	0,962
	Avchala	1458	414	3	3	685	685	1968	1991	0,98	0,98	0,921	0,872
KUTAISI	TROLLEYBUSTRACTION SUBSTATIONS												
	Tseva - I	1049	700	4	4	685	685	1967	1990	0,98	0,98	0,921	0,872
	Tseva - II	524	350	2	2	685	685	1969	1992	0,98	0,98	0,921	0,872
	Tseva - III	786	525	3	3	685	685	1968	1991	0,98	0,98	0,921	0,872
	Tseva - IV	524	350	2	2	685	685	1978	2001	0,98	0,98	0,941	0,921
	Tseva - V	786	525	3	3	685	685	1980	2003	0,98	0,98	0,95	0,921

URBAN TRANSPORT – MAIN CHARACTERISTIC S OF TROLLEYBUSES AN D TRAMWAY SUBSTATIONS' UNITS (1990 AND 1999)

Table 19-2

City	Traction substation	CONTACT -WIRE LINES															
		Cross-section area of wire, mm^2		Length of contact-wire line, km		Permissible value of current strength , A		Losses in contact lines				Total losses					
								Designed, Thousand kWh		Actual, Thousand kWh		Designed, Thousand kWh		Actual, Thousand kWh		Difference, Thousand kWh	
		1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
TBILISI	TROLLEYBUSTRACTION SUBSTATIONS																
	Avlabari	85	85	250	250	450	450	914,784	228,775	914,784	247,01	2211,045	584,359	4849,184	1629,97	2638,139	1045,611
	Sanapiro	85	85	250	250	450	450										
	Saburtalo-I	85	85	250	250	450	450										
	Saburtalo –II	85	85	250	250	450	450										
	Tsentraluri	85	85	250	250	450	450										
	Saburtalo	85	85	250	250	450	450										
	Delisi	85	85	250	250	450	450										
	Digomi – I	85	85	250	250	450	450										
	Digomi – II	85	0	250	0	450	0										
	Varketili	85	0	250	0	450	0										
	Tseronisi	85	85	250	250	450	450										
	CENTRAL TRACTION SUBSTATIONS																
	Farekhi	85	85	250	250	450	450										
	Ortachala	85	85	250	250	450	450										
	Navtlugi	85	85	250	250	450	450										
	Javakheti	85	85	250	250	450	450										
	Didube	85	85	250	250	450	450										
	TRAMWAY TRACTION SUBSTATIONS																
	Depo-avchala	85	85	250	250	450	450										
	Grmagele	85	85	250	250	450	450										
	Avchala	85	85	250	250	450	450										
KUTAISI	TROLLEYBUSTRACTION SUBSTATIONS																
	Tseva - I	85	85	120	120	450	450	336,378	253,316	336,378	273,581	525,208	356,887	778,119	670,063	252,91	313,176
	Tseva - II	85	85	120	120	450	450										
	Tseva - III	85	85	120	120	450	450										
	Tseva - IV	85	85	120	120	450	450										
	Tseva - V	85	85	120	120	450	450										

MAIN CHARACTERISTICS OF SUBWAY SUBSTATIONS' UNITS
by the state of 1990 and 1999
(POWER TRANSFORMERS)

Table 20-1

No.	Name of substation	Subway station supplemented with substation	Electricity supplied to the substations, Thousand kWh		Type of substation disposition	Date of putting into operation of Substation, Year	Power transformer									
							Date of putting into operation, Year	Number of Units		Nominal capacity, KVA		Expiry date of exploitation, Year	Efficiency			
													Designed		Actual	
1	2	3	4		5	6	7	8		9		10	11		12	
			1990	1999				1990	1999	1990	1999		1990	1999	1990	1999
CS- compatible substations																
1	CS-1	Eldepo	10140,48	8039,02	o/d	1966	1987	2	2	400	400	2019	0,98	0,98	0,98	0,96
2	CS-5	Vagzali	1529,78	1465,06	u/g	1979	1979	2	2	400	400	2002	0,98	0,98	0,96	0,951
3	CS-6	Tsereteli	3087,52	2542,91	u/g	1979	1979	2	2	630	630	2002	0,98	0,98	0,96	0,951
4	CS-7	Politeqnikuri	4514,82	3632,63	u/g	1979	1979	2	2	1000	1000	2002	0,98	0,98	0,96	0,951
5	CS-1	Sameditsino	1806,08	1676,02	u/g	1979	1979	2	2	1000	1000	2002	0,98	0,98	0,96	0,951
6	CS-2	Gotsiridze	978,55	865,96	u/g	1979	1979	2	2	1000	1000	2002	0,979	0,979	0,96	0,951
7	CS-3	Grmagele	1590,22	1399,79	u/g	1989	1989	2	2	1000	1000	2012	0,98	0,98	0,98	0,97
8	CS-4	Guramishvili	5049,72	4040,99	u/g	1989	1989	2	2	1000	1000	2012	0,98	0,98	0,98	0,97
9	CS-5	Varketili	3530,72	2881,31	u/g	1989	1989	2	2	1000	1000	2012	0,98	0,98	0,98	0,97
10	CS-6	Saradjishvili	3627,32	2954,99	u/g	1990	1990	2	2	1000	1000	2013	0,98	0,98	0,98	0,97
11	CS-7	Axmeteli	4078,32	3299,29	u/g	1990	1990	2	2	1000	1000	2013	0,98	0,98	0,98	0,97
Ts- Traction substations																
12	Ts-2	Mardjanishvili	8164,6	6233,406	o/d	1966	1987	2	2	160	160	2010	0,962	0,962	0,98	0,96
13	Ts-3	Avlabari	10653,6	8133,636	o/d	1967	1987	2	2	160	160	2010	0,962	0,962	0,98	0,96
14	Ts-4	Samgori	5911,2	4512,96	o/d	1971	1971	2	2	160	160	1994	0,962	0,962	0,951	0,951
SDS - Step-down substations																
15	SDS-1	Nadzaladevi	917,9	938,483	u/g	1966	1966	2	2	320	320	1989	0,98	0,98	0,941	0,931
16	SDS-2	Vagzali	2151,34	2199,57	u/g	1966	1966	2	2	750	750	1989	0,98	0,98	0,941	0,931
17	SDS-3	Mardjanishvili	1606,33	1642,346	u/g	1966	1966	2	2	560	560	1989	0,98	0,98	0,941	0,931
18	SDS-4	Rustaveli	1606,33	1642,346	u/g	1966	1966	2	2	560	560	1989	0,98	0,98	0,941	0,931
19	SDS-5	Tavisuplebis moedani	1606,33	1642,346	u/g	1967	1967	2	2	560	560	1990	0,98	0,98	0,951	0,931
20	SDS-6	Avlabari	1606,33	1642,346	u/g	1967	1967	2	2	560	560	1990	0,98	0,98	0,951	0,931
21	SDS-7	300 Aragveli	917,9	938,483	u/g	1967	1967	2	2	320	320	1990	0,98	0,98	0,951	0,931
22	SDS-8	Isani	1606,31	1642,346	u/g	1971	1971	2	2	560	560	1994	0,98	0,98	0,951	0,941
23	SDS-9	Samgori	1606,3	1642,326	u/g	1971	1971	2	2	560	560	1994	0,98	0,98	0,951	0,941
24	SDS-10	Vaja-pshavela	0	1642,326	u/g	1999	0	0	2	0	560		0	0,98	0	0,98
TOTAL			**78288**	**67250,89**												

Note: o/d – outdoor
u/g – underground

MAIN CHARACTERISTICS OF SUBWAY SUBSTATIONS' UNITS
by the state of 1990 and 1999
(LIGHTING TRANSFORMER AND CONVERT ING POWER TRANSFORMERS)

Table 20-2

No.	Name of substation	Subway station supplemented with substation	Lighting power transformers				Converting power transformers									
			Number of Units		Nominal capacity, KVA		Date of putting into operation, Year	Number of Units		Nominal capacity, KVA		Efficiency				Expiry date of exploitation, Year
												Designed		Actual		
1	2	3	4		5		6	7		8		9		10		11
			1990	1999	1990	1999		1990	1999	1990	1999	1990	1999	1990	1999	
CS- compatible substations																
1	CS-1	Eldepo	1	1	40	40	1966	1	1	1385	1385	0,98	0,98	0,901	0,95	1983
2	CS-5	Vagzali					1979	4	4	1515	1515	0,98	0,98	0,941	0,921	2002
3	CS-6	Tsereteli					1979	4	4	1515	1515	0,98	0,98	0,941	0,921	2002
4	CS-7	Politeqnikuri					1979	4	4	1515	1515	0,98	0,98	0,941	0,921	2002
5	CS-1	Sameditsino					1979	4	4	1515	1515	0,98	0,98	0,941	0,921	2002
6	CS-2	Gotsiridze					1979	2	2	1515	1515	0,98	0,98	0,941	0,921	2002
7	CS-3	Grmagele					1989	4	4	1515	1515	0,98	0,98	0,98	0,941	2012
8	CS-4	Guramishvili					1989	3	3	1515	1515	0,98	0,98	0,98	0,941	2012
9	CS-5	Varketili					1989	1	1	1515	1515	0,98	0,98	0,98	0,941	2012
10	CS-6	Saradjishvili					1990	3	3	1515	1515	0,98	0,98	0,98	0,941	2013
11	CS-7	Axmeteli					1990	3	3	1515	1515	0,98	0,98	0,98	0,941	2013
Ts- Traction substations																
12	Ts-2	Mardjanishvili	1	1	40	40	1966	3	3	1385	1385	0,98	0,98	0,901	0,95	1989
13	Ts-3	Avlabari	2	2	16	16	1967	3	3	2850	2850	0,98	0,98	0,921	0,872	1990
14	Ts-4	Samgori	1	1	16	16	1971	3	3	2850	2850	0,98	0,98	0,921	0,901	1994
SDS - Step-down substations																
15	SDS -1	Nadzaladevi	2	2	180	180										
16	SDS -2	Vagzali	2	2	180	180										
17	SDS -3	Mardjanishvili	2	2	180	180										
18	SDS -4	Rustaveli	2	2	180	180										
19	SDS -5	Tavisuplebis moedani	2	2	180	180										
20	SDS -6	Avlabari	2	2	180	180										
21	SDS -7	300 Aragveli	2	2	180	180										
22	SDS -8	Isani	2	2	160	160										
23	SDS -9	Samgori	2	2	160	160										
24	SDS -10	Vazha-pshavela	0	2	0	160										

MAIN CHARACTERISTICS OF SUBWAY SUBSTATIONS' UNITS

by the state of 1990 and 1999

(CONVERTERS)

Table 20-3

No.	Substation	Subway station with substation	CONVERTERS												Expiry date of exploitation, Year
			Date of putting into operation, Year	Number of Units		Nominal value of direct current, A		Nominal value of direct voltage, V		Efficiency				
										Designed		Actual		
1	2	3	4	5		6		7		8		9		10
				1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	
CS- compatible substations														
1	CS-1	Eldepo	1966	1	1	2600	2600	825	825	0,975	0,975	0,945	0,965	1980
2	CS-5	Vagzali	1979	4	4	1600	1600	825	825	0,975	0,975	0,96	0,955	1993
3	CS-6	Tsereteli	1979	4	4	1600	1600	825	825	0,975	0,975	0,96	0,955	1993
4	CS-7	Politeqnikuri	1979	2	2	1600	1600	825	825	0,975	0,975	0,96	0,955	1993
5	CS-1	Sameditsino	1988	4	4	1600	1600	825	825	0,975	0,975	0,975	0,96	2002
6	CS-2	Gotsiridze	1979	2	2	1600	1600	825	825	0,975	0,975	0,96	0,955	1993
7	CS-3	Grmagele	1989	4	4	1600	1600	825	825	0,975	0,975	0,975	0,96	2003
8	CS-4	Guramishvili	1989	3	3	1600	1600	825	825	0,975	0,975	0,975	0,96	2003
9	CS-5	Varketili	1989	3	3	1600	1600	825	825	0,975	0,975	0,975	0,96	2003
10	CS-6	Saradjishvili	1990	3	3	1600	1600	825	825	0,975	0,975	0,975	0,965	2004
11	CS-7	Axmeteli	1990	3	3	1600	1600	825	825	0,975	0,975	0,975	0,965	2004
Ts- Traction substations														
12	Ts-2	Mardjanishvili	1966	3	3	2600	2600	825	825	0,975	0,975	0,945	0,965	1980
13	Ts-3	Avlabari	1967	3	3	5000	5000	825	825	0,975	0,975	0,945	0,936	1981
14	Ts-4	Samgori	1971	3	3	5000	5000	825	825	0,975	0,975	0,955	0,941	1985

TOTAL VALUES	Electricity supplied to the substations, Thousand kWh		TOTAL LOSES											
			Absolute, mln.kWh						Ratio, %					
			Designed		Actual		difference		Designed		Actual		difference	
	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
	78288	**67250,89**	4287,27	3486,36	8989,3	8740,63	4702,03	5254,27	5,48	5,18	11,48	13,00	6,01	7,81

MAIN CHARACTERISTICS OF GEORGIA'S RAILWAY SUBSTATIONS

by the state of 1990 and 1999

(POWER TRANSFORMERS)

Table 21

No	Substation	Date of putting into operation, Year	POWER TRANSFORMER										
			Number of Units		Date of putting into operation, Year	Nominal capacity, KVA		Efficien cy				Expiry date of exploitation, Year	
								Designed		Actual			
1	2	3	4		5	6		7		8		9	
			1990	1999		1990	1999	1990	1999	1990	1999	1990	1999
110 kV													
1	Magaro	1969	2	2	1969	10	10	0,98	0,98	0,951	0,931	1992	1992
2	Gachiani	1972	2	2	1972	10	10	0,98	0,98	0,951	0,941	1995	1995
3	Shulaveri	1988	2	2	1988	10	10	0,98	0,98	0,98	0,96	2011	2011
4	Sadakhlo	1963	2	2	1963	10	10	0,98	0,98	0,941	0,921	1986	1986
5	Kumisi	1980	2	2	1980	10	10	0,98	0,98	0,97	0,951	2003	2003
6	Pokani	1987	2	2	1987	10	10	0,98	*N.A.	0,98	N.A.	2010	2010
7	Trialeti	1987	2	2	1987	10	10	0,98	0,98	0,98	0,96	2010	2010
8	Bedeni	1987	2	2	1987	10	10	0,98	0,98	0,98	0,96	2010	2010
9	Tetri-Tskaro	1984	2	2	1984	16	16	0,98	0,98	0,97	0,96	2007	2007
10	Ksani	1965	1	1	1965	15	15	0,98	0,98	0,941	0,931	1988	1988
11	Kavtiskhevi	1987	2	2	1987	16	16	0,98	0,98	0,98	0,96	2010	2010
12	Metekhi	1966	1	1	1966	15	15	0,98	0,98	0,941	0,931	1989	1989
13	Kareli	1988	2	2	1988	10	10	0,98	0,98	0,98	0,96	2011	2011
14	Agara	1961	2	2	1961	10	10	0,98	0,98	0,941	0,921	1984	1984
15	Likhi	1975	2	2	1975	10	10	0,98	0,98	0,96	0,941	1998	1998
16	Tsipa	1962	2	2	1962	20	20	0,98	0,98	0,941	0,921	1985	1985
17	Moliti	1932	2	2	1932	10	10	0,98	0,98	0,921	0,921	1955	1955
18	Marelisi	1971	2	2	1971	10	10	0,98	0,98	0,951	0,941	1994	1994
19	Khashuri	1932	2	2	1932	10	10	0,98	0,98	0,921	0,921	1955	1955
20	Atskuri	1971	2	2	1971	6,3	6,3	0,98	0,98	0,951	0,941	1994	1994
21	Dzirula	1936	2	2	1936	10	10	0,98	0,98	0,921	0,921	1959	1959
22	Sviri	1983	2	2	1983	10	10	0,98	0,98	0,97	0,951	2006	2006
23	Kopitnari	1967	2	2	1967	10	10	0,98	0,98	0,951	0,931	1990	1990
24	Lanchkhuti	1991	-	2	1991	-	16	-	0,98	-	0,97	2014	2014
25	Abasha	1958	2	2	1958	10	10	0,98	0,98	0,931	0,921	1981	1981
26	Kheta	1981	2	2	1981	10	10	0,98	N.A.	0,97	N.A.	2004	2004
27	Achigvara	1971	1	1	1971	15	15	0,98	N.A.	0,951	N.A.	1994	1994
28	Gali	1983	2	N.A.	1983	10	N.A.	0,98	N.A.	0,97	N.A.	2006	N.A.
29	Ochamchire	1969	1	N.A.	1969	10	N.A.	0,98	N.A.	0,951	N.A.	1992	N.A.
30	Adziubja	1955	2	N.A.	1955	16	N.A.	0,98	N.A.	0,931	N.A.	1978	N.A.

Cont.Table 21

1	2	3	4		5	6		7		8		9	
31	Gudauta	1954	1	N.A.	1954	15	N.A.	0,98	N.A.	0,921	N.A.	1977	N.A.
32	Miusera	1972	2	N.A.	1972	10	N.A.	0,98	N.A.	0,951	N.A.	1995	N.A.
33	Bzipi	1957	1	N.A.	1957	5,6	N.A.	0,98	N.A.	0,931	N.A.	1980	N.A.
34	Gantiadi	1956	2	N.A.	1956	5,6	N.A.	0,98	N.A.	0,931	N.A.	1979	N.A.
35 kV													
35	Iori	1982	-	-	-	-	-	-	-	-	-	-	-
36	Vaziani	1990	-	-	-	-	-	-	-	-	-	-	-
37	Tckhradzma	1985	2	2	1985	1,6	1,6	N.A.	N.A.	N.A.	N.A.	2008	2008
38	Tb.sakvandzo	1939	-	-	-	-	-	-	-	-	-	-	-
39	Zahesi	1935	2	2	1935	5,6	5,6	0,98	0,98	0,921	0,921	1958	1958
40	Sakochavi	1967	-	-	-	-	-	-	-	-	-	-	-
41	Kharagauli	1958	-	-	-	-	-	-	-	-	-	-	-
42	Khresili	1948	1	1	1948	2,5	2,5	0,98	0,98	0,921	0,921	1971	1971
43	Rioni	1936	-	-	-	-	-	-	-	-	-	-	-
44	Natanebi	1954	1	1	1954	4	4	0,98	0,98	0,921	0,921	1977	1977
45	Poti	1951	-	-	-	-	-	-	-	-	-	-	-
46	Tkvarcheli	1957	-	-	-	-	-	-	-	-	-	-	-

*N.A. - *not available*

MAIN CHARACTERISTICS OF GEORGIA'S RAILWAY SUBSTATIONS

by the state of 1990 and 1999

((TRACTION-FEEDING TRANSFORMERS)

Table 22-1

No	Traction substation	Electricity supplied to the substations, Thousand kWh		Traction-feeding transformers									
				Units		Date of putting into operation, Year	Nominal capacity, KVA		Efficiency				Expiry date of exploitation, Year
									Designed		Actual		
1	2	3		4		5	6		7		8		9
				1990	1999		1990	1999	1990	1999	1990	1999	1990	1999
110 kV														
1	Magaro	9570	-	4	4	1969	4,17	4,17	0,98	0,98	0,921	0	1992	1992
2	Gachiani	9570	6440,288	2	2	1972	11,84	11,84	0,98	0,98	0,921	0,901	1995	1995
3	Shulaveri	9570	128,32	2	2	1988	11,8	11,8	0,98	0,98	0,98	0,941	2011	2011
4	Sadakhlo	9570	720	3	3	1963	3,7	3,7	0,98	0,98	0,901	0,862	1986	1986
5	Kumisi	9570	2655,88	2	2	1980	11,8	11,8	0,98	0,98	0,95	0,921	2003	2003
6	Pokani	9570	-	2	2	1987	11,8	11,8	0,98	0,98	0,98	-	2010	2010
7	Trialeti	9570	324,8	2	2	1987	11,8	11,8	0,98	0,98	0,98	0,941	2010	2010
8	Bedeni	9570	256	2	2	1987	11,8	11,8	0,98	0,98	0,98	0,941	2010	2010
9	Tetri-Tskaro	15312	529,2	2	2	1984	11,8	11,8	0,98	0,98	0,95	0,941	2007	2007
10	Ksani	14834	3927,816	1	1	1965	8,65	8,65	0,98	0,98	0,901	0,872	1988	1988
11	Kavtiskhevi	15312	3455,76	2	2	1987	11,84	11,84	0,98	0,98	0,98	0,941	2010	2010
12	Metekhi	14834	1208,454	2	2	1966	11,84	11,84	0,98	0,98	0,901	0,872	1989	1989
13	Kareli	9570	1326	2	2	1988	4,64	4,64	0,98	0,98	0,98	0,941	2011	2011
14	Agara	9570	949,408	2	2	1961	3,5	3,5	0,98	0,98	0,901	0,872	1984	1984
15	Likhi	9570	303,96	2	2	1975	11,1	11,1	0,98	0,98	0,941	0,941	1998	1998
16	Tsipa	19140	16885,12	2	2	1962	11,1	11,1	0,98	0,98	0,901	0,862	1985	1985
17	Moliti	9570	11631,264	1	1	1932	11,84	11,84	0,98	0,98	0,941	0,921	1955	1955
18	Marelisi	9570	3941,28	2	2	1971	3,7	3,7	0,98	0,98	0,921	0,901	1994	1994
19	Khashuri	9570	5457,408	2	2	1932	11,84	11,84	0,98	0,98	0,941	0,921	1955	1955
20	Atskuri	6029	3665,88	4	4	1971	3,5	3,5	0,98	0,98	0,921	0,901	1994	1994
21	Dzirula	9570	20294,789	4	4	1976	4,64	4,64	0,98	0,98	0,941	0,921	1959	1959
22	Sviri	9570	628,8	2	2	1983	4,64	4,64	0,98	0,98	0,95	0,921	2006	2006
23	Kopitnari	9570	4578	3	3	1967	3,7	3,7	0,98	0,98	0,921	0,872	1990	1990
24	Samtredia-II	-	7376,16	-	2	1991	-	12,5	-	0,98	-0	0,950	2014	2014
25	Lanchkhuti	9570	3333,288	2	2	1958	3,7	3,7	0,98	0,98	0,872	0,862	1981	1981
26	Abasha	9570	N.A.	2	2	1981	4,64	4,64	0,98	0,98	0,95	N.A.	2004	2004
27	Kheta	7178	N.A.	1	1	1971	3,7	3,7	0,98	0,98	0,921	N.A.	1994	1994
28	Achigvara	9570	N.A.	2	N.A.	1983	4,64	N.A.	0,98	N.A.	0,95	N.A.	2006	N.A.
29	Gali	5785	N.A.	2	N.A.	1969	3,7	N.A.	0,98	N.A.	0,921	N.A.	1992	N.A.
30	Ochamchire	15312	N.A.	2	N.A.	1955	3,7	N.A.	0,98	N.A.	0,872	N.A.	1978	N.A.
31	Adziubja	11963	N.A.	2	N.A.	1954	3,7	N.A.	0,98	N.A.	0,862	N.A.	1977	N.A.

Cont. Table 22-1

1	2	3		4		5	6		7		8		9	
32	Gudauta	6029	N.A.	2	N.A.	1956	11,84	N.A.	0,98	N.A.	0,872	N.A.	1979	N.A.
33	Miusera	9570	N.A.	2	N.A.	1972	N.A.	N.A.	0,98	N.A.	0,921	N.A.	1995	N.A.
34	Bzipi	12250	N.A.	2	N.A.	1957	3,7	N.A.	0,98	N.A.	0,872	N.A.	1980	N.A.
35	Gantiadi	6359	N.A.	3	N.A.	1956	3,7	N.A.	0,98	N.A.	0,872	N.A.	1979	N.A.
	35 kV													
36	Iori	5307	N.A.	2	2	1982	4,64	4,64	0,98	0,98	0,95	-	2005	2005
37	Vaziani	4037	1063,303	2	2	1990	4,64	4,64	0,98	0,98	0,98	0,95	2013	2013
38	Tckhradzma	3531	N.A.	4	4	1985	4,66	4,66	0,98	0,98	0,98	0,941	2008	2008
39	Tb.sakvandzo	6699	6952,4	2	2	1976	3,7	3,7	0,98	0,98	0,941	0,921	1999	1999
40	Zahesi	5838	14896	2	2	1976	3,7	3,7	0,98	0,98	0,941	0,921	1999	1999
41	Sakochavi	2416	171,36	2	2	1967	1,85	1,85	0,98	0,98	0,901	0,872	1990	1990
42	Kharagauli	7513	125,535	1	1	1958	4,64	4,64	0,98	0,98	0,872	0,862	1981	1981
43	Khresili	2196	1854,962	2	2	1976	4,654	4,654	0,98	0,98	0,941	0,921	1999	1999
44	Rioni	11484	6167,7	2	2	1976	11,83	11,83	0,98	0,98	0,941	0,921	1999	1999
45	Natanebi	2914	651	2	2	1977	4,64	4,64	0,98	0,98	0,941	0,921	2000	2000
46	Foti	4307	857,582	2	2	1977	4,64	4,64	0,98	0,98	0,941	0,921	2000	2000
47	Tkvarcheli	3350	N.A.	2	N.A.	1957	3,5	N.A.	0,98	N.A.	0,872	N.A.	1980	N.A.
	10 kV													
48	Bolnisi	11484	2938,562	2	2	1978	11,8	11,8	0,98	0,98	0,941	0,921	2001	2001
49	Marneuli	5264	1667,2	2	2	1963	3,3	3,3	0,98	0,98	0,901	0,962	1986	1986
50	Gurdjaani	6699	825,6	4	4	1969	3,5	3,5	0,98	0,98	0,921	0,872	1992	1992
51	Dedoflistskaro	4541	542,7	2	2	1966	3,7	3,7	0,98	0,98	0,901	0,872	1989	1989
52	Kachreti	9092	819,2	4	4	1969	4,66	4,66	0,98	0,98	0,921	0,872	1992	1992
53	Sagaredjo	7178	596,8	4	4	1968	3,6	3,6	0,98	0,98	0,921	0,872	1991	1991
54	Gori	3541	8548,8	2	2	1976	3,7	3,7	0,98	0,98	0,941	0,921	1999	1999
55	Akhalcikhe	3301	385,254	1	1	1983	4,64	4,64	0,98	0,98	0,95	0,921	2006	2006
56	Sufsa	4402	4096,408	2	2	1982	4,64	4,64	0,98	0,98	0,95	0,921	2005	2005
57	Qubuleti	4402	6561,6	2	2	1976	4,64	4,64	0,98	0,98	0,941	0,921	1999	1999
58	Senaki	4785	4042,4	2	2	1977	5	5	0,98	0,98	0,941	0,921	2000	2000
59	DrandaSokhumi	4402	N.A.	2	N.A.	1982	4,64	N.A.	0,98	N.A.	0,95	N.A.	2005	N.A.
60	Akhaliatoni	3541	N.A.	4	N.A.	1955	3,7	N.A.	0,98	N.A.	0,872	N.A.	1978	N.A.
61	Bolnisi	9092	N.A.	4	N.A.	1973	4,614	N.A.	0,98	N.A.	0,921	N.A.	1996	N.A.

Cont. Table 22-1

1	2	3	4	5	6	7	8	9						
6 kV														
62	Rustavi	7452	7953,6	1	1	1976	4,37	4,37	0,98	0,98	0,941	0,921	1999	1999
63	Didube	6407	858,486	1	1	1984	11,84	11,84	0,98	0,98	0,95	0,941	2007	2007
64	Bordjomi	3701	848,646	2	2	1966	1,85	1,85	0,98	0,98	0,901	0,872	1989	1989
65	Zestafoni	3227	1235,16	2	2	1957	1,84	1,84	0,98	0,98	0,872	0,862	1980	1980
66	Tkibuli	9241	3839,76	2	2	1976	11,84	11,84	0,98	0,98	0,941	0,921	1999	1999
67	Samtredia-I	1770	N.A.	2	2	1975	1,85	1,85	0,98	N.A.	0,941	N.A.	1998	1998
68	Batumi	9300	N.A.	2	2	1976	11,84	11,84	0,98	N.A.	0,941	N.A.	1999	1999
69	Ingiri	3420	2688,84	2	2	1977	4,64	4,64	0,98	0,98	0,941	0,921	2000	2000
70	Gagra	3541	1092,08	2	2	1977	3,7	3,7	0,98	0,98	0,941	0,921	2000	2000
71	Rustavi	3618	N.A.	1	N.A.	1974	4,64	N.A.	0,98	N.A.	0,921	N.A.	1997	N.A.
TOTAL		544300	182298,653											

TOTAL VALUES	Electricity supplied to the substations, Thousand kWh		TOTAL LOSES											
			Absolute, mln.kWh						Ratio, %					
			Designed		Actual		difference		Designed		Actual		difference	
	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
	544300	182298,65	83377,2	27418,6	144859,3	53236,1	61482,1	25817,4	15,32	15,04	26,61	29,20	11,30	14,16

MAIN CHARACTERISTICS OF GEORGIA'S RAILWAY SUBSTATIONS
by the state of 1990 and 1999
(CONVERTERS)

Table 2.2-2

No	Name of traction substation	CONVERTERS														
		Number of Units		Date of putting into operation, Year	Nominal value of direct current, A		Nominal value of direct voltage, V		Nominal capacity, KVA		Efficiency				Expiry date of exploitation, Year	
											Designed		Actual			
1	2	3		4	5		6		7		8		9		10	
		1990	1999		1990	1999	1990	1999	1990	1999	1990	1999	1990	1999	1990	1999
110 kV																
1	Magaro	1	1	1969	3000	3000	3300	3300	9,9	9,9	0,975	N.A.	0,945	N.A.	1983	1983
2	Gachiani	1	1	1972	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,955	0,941	1986	1986
3	Shulaveri	2	2	1988	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,975	0,96	2002	2002
4	Sadakhlo	2	2	1963	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1992	1992
5	Kumisi	2	2	1980	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,955	1994	1994
6	Pokani	2	2	1987	3000	3000	3300	3300	9,9	9,9	0,975	N.A.	0,975	N.A.	2001	2001
7	Trialeti	2	2	1987	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,975	0,96	2001	2001
8	Bedeni	2	2	1987	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,975	0,96	2001	2001
9	Tetri-Tskaro	2	2	1984	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,965	0,955	1998	1998
10	Ksani	2	2	1965	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,945	0,936	1979	1979
11	Kavtiskhevi	2	2	1987	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,975	0,96	2001	2001
12	Metekhi	2	2	1966	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,945	0,936	1980	1980
13	Kareli	2	2	1988	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,975	0,96	2002	2002
14	Agara	2	2	1961	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1992	1992
15	Likhi	2	2	1975	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,955	0,945	1989	1989
16	Tsipa	1	1	1962	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990
17	Moliti	1	1	1932	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990
18	Marelisi	2	2	1971	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,955	0,941	1985	1985
19	Khashuri	2	2	1932	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990
20	Atskuri	2	2	1971	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,955	0,941	1985	1985
21	Dzirula	2	2	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990
22	Sviri	2	2	1983	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,965	0,955	1997	1997
23	Kopitnari	2	2	1967	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,945	0,936	1991	1981
24	Samtredia-II	-	2	1991	-	3000	-	3300	-	9,9	-	0,975	-	0,965	-	2014
25	Lanchkhuti	2	2	1958	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1991	1991
26	Abasha	2	2	1981	3000	3000	3300	3300	9,9	9,9	0,975	N.A.	0,965	N.A.	1995	1995
27	Kheta	2	2	1971	3000	3000	3300	3300	9,9	9,9	0,975	N.A.	0,955	N.A.	1985	1985
28	Achigvara	2	N.A.	1983	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,965	N.A.	1997	N.A.
29	Gali	1	N.A.	1969	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,945	N.A.	1983	N.A.

Cont. Table 22-2

1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7
30	Ochamchire	2	N.A.	1955	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,936	N.A.	1969	N.A.
31	Adziubja	2	N.A.	1954	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,931	N.A.	1968	N.A.
32	Gudauta	2	N.A.	1956	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,936	N.A.	1970	N.A.
33	Miusera	2	N.A.	1972	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,955	N.A.	1986	N.A.
34	Bzipi	1	N.A.	1957	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,936	N.A.	1971	N.A.
35	Gantiadi	1	N.A.	1956	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,936	N.A.	1970	N.A.
35 kV																
36	Iori	1	1	1982	3000	3000	3300	3300	9,9	9,9	0,975	N.A.	0,965	N.A.	1996	1996
37	Vaziani	2	2	1990	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,975	0,965	2004	2004
38	Tckhradzma	2	2	1985	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,975	N.A.	1999	1999
39	Tb.sakvandzo	2	2	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990
40	Zahesi	2	2	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990
41	Sakochavi	2	2	1967	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,945	0,936	1981	1981
42	Kharagauli	3	3	1958	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1991	1991
43	Khresili	1	1	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990
44	Rioni	2	2	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990
45	Natanebi	2	2	1977	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1991	1991
46	Poti	2	2	1977	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1991	1991
47	Tkvarcheli	1	N.A.	1957	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,936	N.A.	1971	0
10 kV																
48	Bolnisi	2	2	1978	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1992	1992
49	Marneuli	1	1	1963	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1992	1992
50	Gurdjaani	2	2	1969	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,945	0,945	1983	1983
51	Dedoflistskaro	1	1	1966	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,945	0,941	1980	1980
52	Kachreti	1	1	1969	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,945	0,936	1983	1983
53	Sagaredjo	1	1	1968	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,945	0,941	1982	1982
54	Gori	2	2	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,936	1990	1990
55	Akhalcikhe	1	1	1983	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,965	0,945	1997	1997
56	Sufsa	2	2	1982	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,965	0,955	1996	1996
57	Qubuleti	2	2	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,955	1990	1990
58	Senaki	2	2	1977	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1991	1991
59	DrandaSokhumi	2	N.A.	1982	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,965	N.A.	1996	N.A.
60	Akhaliatoni	2	N.A.	1955	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,936	N.A.	1969	N.A.
61	Bolnisi	2	N.A.	1973	3000	N.A.	3300	N.A.	9,9	N.A.	0,975	N.A.	0,955	N.A.	1987	N.A.
6 kV																
62	Rustavi	1	1	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990

Cont. Table 22-2

1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7
63	Didube	2	2	1984	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,965	0,955	1998	1998
64	Bordjomi	2	2	1966	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,945	0,936	1980	1980
65	Chiatura	2	3	1957	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1991	1991
66	Zestafoni	2	2	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1990	1990
67	Tkibuli	1	1	1975	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,955	N.A.	1989	1989
68	Samtredia-I	2	2	1976	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	N.A.	1990	1990
69	Batumi	2	2	1977	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1991	1991
70	Ingiri	2	2	1977	3000	3000	3300	3300	9,9	9,9	0,975	0,975	0,96	0,945	1991	1991
71	Gagra	2	N.A.	1974	3000	N.A.	3300	N.A.	9,9	N.A.	0.975	N.A.	0,955	N.A.	1988	N.A.

THERMAL ENERGY CONSUMPTION IN GEORGIA IN 1990

Table 23-1

No.	District heating objects	Boilers	RESIDENTIAL BUILDINGS													
			Total living space in Georgia, thousand m^2	Area covered by centralized heating stations, thousand m^2	Total number of urban population, thousand persons	Number of residents using centralized heating, thousand persons	Living space per person, m^2/per capita	Heat load for heating, MW/km^2	Heat load for hot water supply, MW/km^2	Total heat load, MW/km^2	THERMAL PARAMETERS					
											Specific indices of heating, systems W/m^2	Specific indices of hot water supply, W/m^2	Specific indices of total heat load, W/m^2	Per capita heating parameters, W/person	Specific indices of hot water supply per capita W/person	Total indices of specific heat load per capita, W/person
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Tbilisi heat supply system	1		267,5	1200	20	13,38	18,68	7,66	26,33	69,82	28,62	98,44	933,8	382,8	1316,6
		2		51,8	1200	2,5	20,72	3,94	1,04	4,99	76,14	20,15	96,29	1577,6	417,6	1995,2
		3		462,4	1200	34,4	13,44	32,13	13,22	45,36	69,49	28,6	98,09	934,07	384,42	1318,49
		4		192,2	1200	10,8	17,8	14,5	4,52	19,02	75,44	23,54	98,98	1342,59	418,89	1761,48
		5		217	1200	22,5	9,64	15,08	8,58	23,66	69,49	39,56	109,05	670,22	381,51	1051,73
		6		499,6	1200	37,8	13,22	34,8	14,5	49,3	69,66	29,02	98,68	920,63	383,6	1304,23
		7		156,4	1200	13,3	11,76	11,83	5,45	17,28	75,65	34,86	110,51	889,62	409,92	1299,54
		8		399,3	1200	18,8	21,24	27,84	7,66	35,5	69,72	19,17	88,9	1480,85	407,23	1888,08
		9		102,5	1200	9,1	11,26	7,77	3,71	11,48	75,82	36,21	112,04	854,07	407,91	1261,98
		10		213,2	1200	14,2	15,01	14,85	5,8	20,65	69,64	27,2	96,85	1045,63	408,45	1454,08
		12		500,5	1200	34	14,72	34,8	12,99	47,79	69,53	25,96	95,49	1023,53	382,12	1405,65
		13		265	1200	16	16,56	18,44	6,5	24,94	69,6	24,51	94,11	1152,75	406	1558,75
		14		267,8	1200	16,5	16,23	18,68	6,73	25,4	69,74	25,12	94,86	1131,88	407,76	1539,64
		16		6,5	1200	0,6	10,83	0,46	0,23	0,7	71,38	35,69	107,08	773,33	386,67	1160
		17		1322	1200	78	16,95	91,99	29,81	121,8	69,58	22,55	92,13	1179,33	382,21	1561,54
		18		612,2	1200	33,4	18,33	42,57	12,88	55,45	69,54	21,03	90,57	1274,61	385,51	1660,12
		19		320,2	1200	17,9	17,89	22,27	7,31	29,58	69,56	22,82	92,38	1244,25	408,27	1652,52
		20		605,8	1200	35,8	16,92	42,11	13,8	55,91	69,51	22,79	92,29	1176,2	385,59	1561,79
		21	18685	476,8	1200	24,4	19,54	33,18	9,4	42,57	69,58	19,71	89,29	1359,67	385,08	1744,75
		22		198,7	1200	11,2	17,74	14,96	4,52	19,49	75,31	22,77	98,08	1336,07	403,93	17407
		23		184,5	1200	11,1	16,62	13,92	4,52	18,44	75,45	24,52	99,97	1254,05	407,57	1661,62

Cont. Table 23-1

1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			24		308,8	1200	24,2	12,76	21,46	9,28	30,74	69,49	30,05	99,55	886,78	383,47	1270,25
			25		393,7	1200	22,3	17,65	27,38	8,58	35,96	69,54	21,8	91,34	1227,62	384,93	1612,55
			26		55,8	1200	4	13,95	4,18	1,62	5,8	74,84	29,1	103,94	1044	406	1450
			27		29,4	1200	2	14,7	2,2	0,81	3,02	74,97	27,62	102,59	1102	406	1508
			28		472,5	1200	32,7	14,45	32,94	12,53	45,47	69,72	26,51	96,24	1007,46	383,12	1390,58
			29		53,6	1200	3,1	17,29	4,06	1,28	5,34	75,75	23,81	99,55	1309,68	411,61	1721,29
			30		118,3	1200	9,2	12,86	8,93	3,71	12,64	75,5	31,38	106,88	970,87	403,48	1374,35
			31		154,5	1200	10,6	14,58	11,6	4,29	15,89	75,08	27,78	102,86	1094,34	404,91	1499,25
			32		212,3	1200	15,7	13,52	14,73	6,38	21,11	69,39	30,05	99,44	938,34	406,37	1344,71
			33		18,5	1200	1,9	9,74	1,39	0,81	2,2	75,24	43,89	119,14	732,63	427,37	1160
			34		54,1	1200	3,2	16,91	4,06	1,28	5,34	75,05	23,59	98,63	1268,75	398,75	1667,5
			35		2,4	1200	0,25	9,6	0,23	0,1	0,34	96,67	43,5	140,17	928	417,6	1345,6
			36		204,6	1200	14,6	14,01	14,27	5,92	20,18	69,74	28,91	98,65	977,26	405,21	1382,47
			37			1200					0						
			39		18,9	1200	0,4	47,25	1,39	0,12	1,51	73,65	6,14	79,79	3480	290	3770
			40		23,6	1200	2,2	10,73	1,74	0,93	2,67	73,73	39,32	113,05	790,91	421,82	1212,73
			41		204	1200	17,9	11,4	14,15	7,31	21,46	69,37	35,82	105,2	790,61	408,27	1198,88
			42			1200					0						
			43		879,6	1200	50,3	17,49	61,25	19,26	80,5	69,63	21,89	91,52	1217,65	382,82	1600,47
			44		739,4	1200	39,9	18,53	51,5	15,31	66,82	69,66	20,71	90,37	1290,83	383,76	1674,59
			45		535,7	1200	36,3	14,76	37,24	13,92	51,16	69,51	25,98	95,49	1025,79	383,47	1409,26
			46		932,1	1200	59,8	15,59	64,84	22,85	87,7	69,57	24,52	94,08	1084,35	382,14	1466,49
			47		183,3	1200	18,5	9,91	13,8	7,54	21,34	75,31	41,13	116,44	746,16	407,57	1153,73
			48		370	1200	37,8	9,79	25,75	14,5	40,25	69,6	39,19	108,79	681,27	383,6	1064,87
	Total in Tbilisi			18685	13287	1200	869	14,83	933,89	339,16	1273,08	69,13	26,6	95,73	1070	378,34	1448,34
2	Boilers for the district heating system	Kutaisi	1 – 3	3288	986,4	238,2	71,6	13,8	172	20	192	N.A.	N.A.	212	N.A.	N.A.	2932
3		Rustavi	1 – 3	2615	1569	161,9	97,14	16,15	215	N.A.	215	N.A.	N.A.	143	N.A.	N.A.	2317
4		Batumi	1 – 3	1850	555	137,5	41,25	13,45	58	N.A.	58	N.A.	N.A.	131	N.A.	N.A.	1769
5		Telavi	1 – 3	600	180	28,6	4,29	20,9	42	N.A.	42	N.A.	N.A.	260	N.A.	N.A.	1095
6		Zestaphoni	1 – 2	432	64,8	26,6	3,93	16,24	11	N.A.	11	N.A.	N.A.	200	N.A.	N.A.	3307
7	The Rest Cities of Georgia		1	26675	5335	1280,2	256	20,83	240	N.A.	240	N.A.	N.A.	44	N.A.	N.A.	937
	Total in Georgia			**54145**	**21977,2**	**3073**	**1343,21**		**1671,89**	**359,16**	**2031,08**			**103,88**			**1520,24**

THERMAL ENERGY CONSUMPTION IN GEORGIA IN 1990

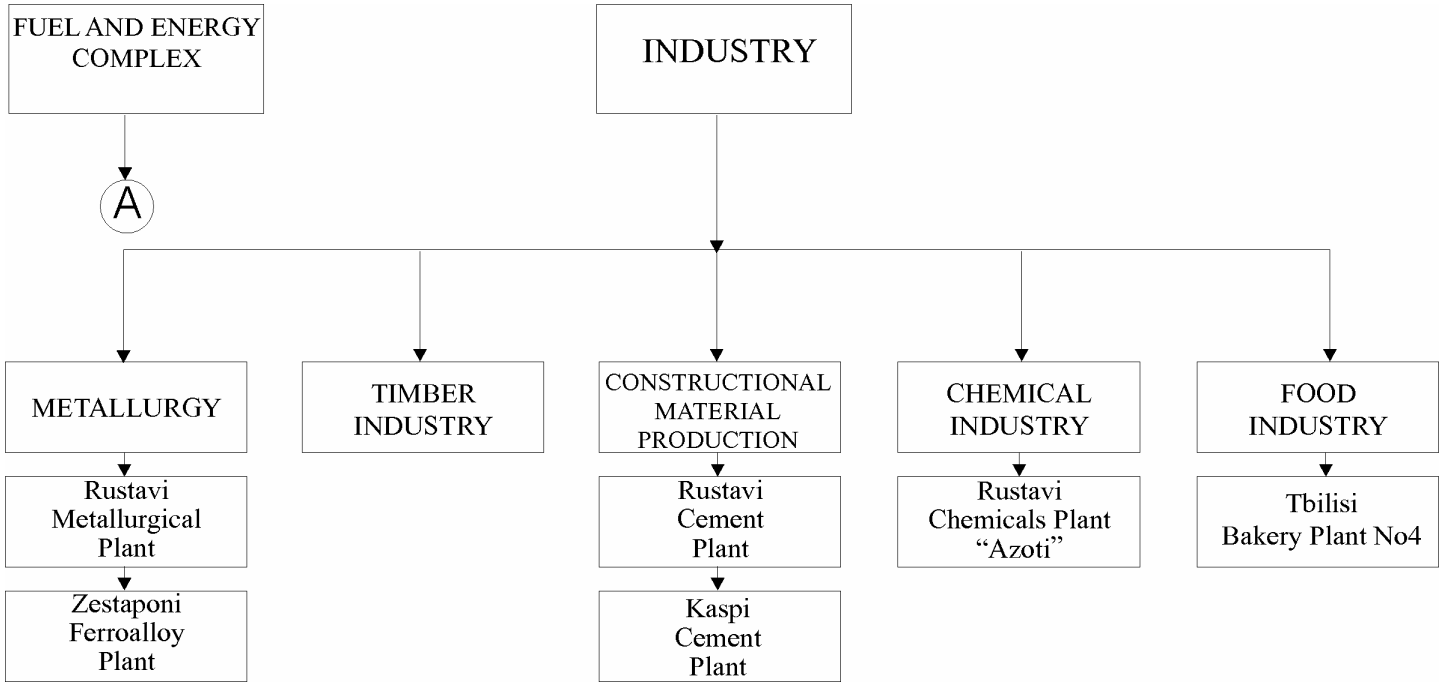
Table 23-2

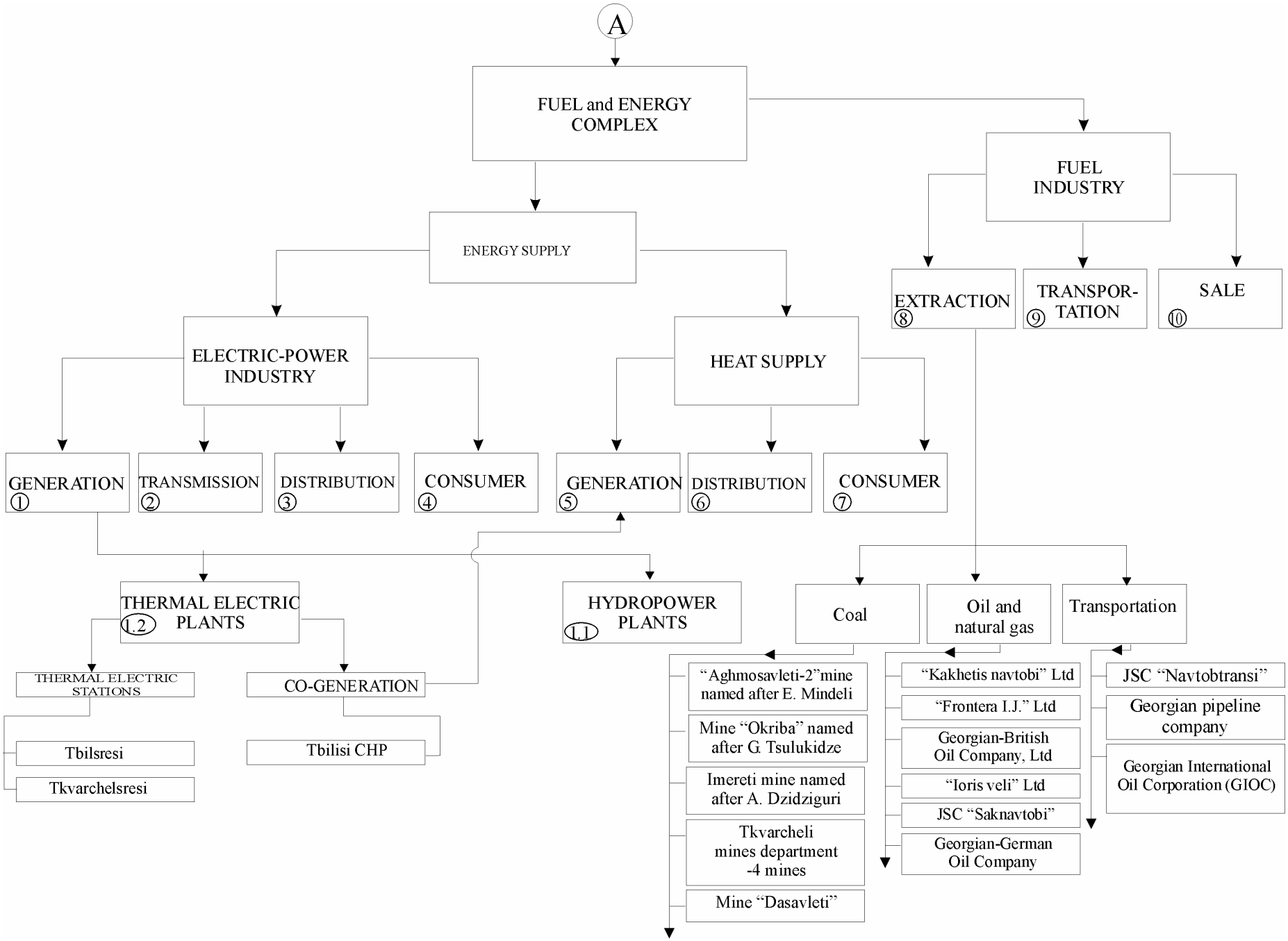
No.	District heating objects	Boilers	PUBLIC BUILDINGS									
			Heating area, thousand m^2	Heat load for heating, MW	Heat load for hot water supply, MW	Total heat load, MW	Heat load of industrial objects, MW	Heat load for residential buildings, MW	Total heat load over the country, MW	THERMAL PARAMETERS		
										Specific indices of heating systems, W/m^2	Specific indices of hot water supply, W/m^2	Specific indices of total heat load, W/m^2
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Tbilisi heat supply system	1	232,5	18,91	5,1	24,01	4,07	26,33	54,4	81,32	21,95	103,27
		2	51,3	4,16	0,35	4,52		4,99	9,51	81,1	7,33	88,43
		3	70	6,03	0,7	6,73	7,01	45,36	59,1	86,17	9,94	96,11
		4	46	3,8	0,18	3,98		19,02	28,23	82,6	3.91	86,51
		5	30	0,24	0,12	0,34		23,66	30,24	80,6	1,55	82,15
		6	412,5	33,5	15,6	49,1		49,3	98,4	80,27	18,84	99,11
		7	17,5	0,7	0,12	0,82		17,28	18,1	82,35	6,63	88,98
		8	252,5	20,5	4,99	25,5		35,5	61	81,31	19,75	101,06
		9	82,5	6,73	0,93	7,62		11,48	19,1	81,51	11,97	93,48
		10	200	16,24	3,02	19,25		20,65	39,9	81,2	15,08	96,28
		12	105	9,16	2,44	11,6	4,99	47,79	64,38	87,28	23,2	110,48
		13	125	10,21	0,7	10,9		24,94	35,84	81,66	5,57	87,23
		14	157,5	25,57	3,83	29,4		25,4	54,8	81,02	24,3	105,32
		16	52,5	4,53	4,29	8,83	19,37	0,7	28,9	86,17	81,75	167,92
		17	107,1	8,7	2,76	11,46	4,84	121,8	138,1	81,2	26,68	107,88
		18	168,8	13,69	1,86	15,53	3,02	55,45	74	81,09	11	92,09
		19	425	34,57	5,22	39,82		29,58	69,4	81,34	12,28	93,62
		20	106,2	8	2,78	10,79		55,91	66,7	81,13	30,1	111,23
		21	152,5	12,41	3,02	15,42	0,81	42,57	58,8	81,39	19,78	101,17
		22	150	12,18	4,29	16,49	17,52	19,49	53,5	81,2	28,61	109,81
		23	80	6,96	0,28	7,24	2,32	18,44	28	87	2,9	89,9

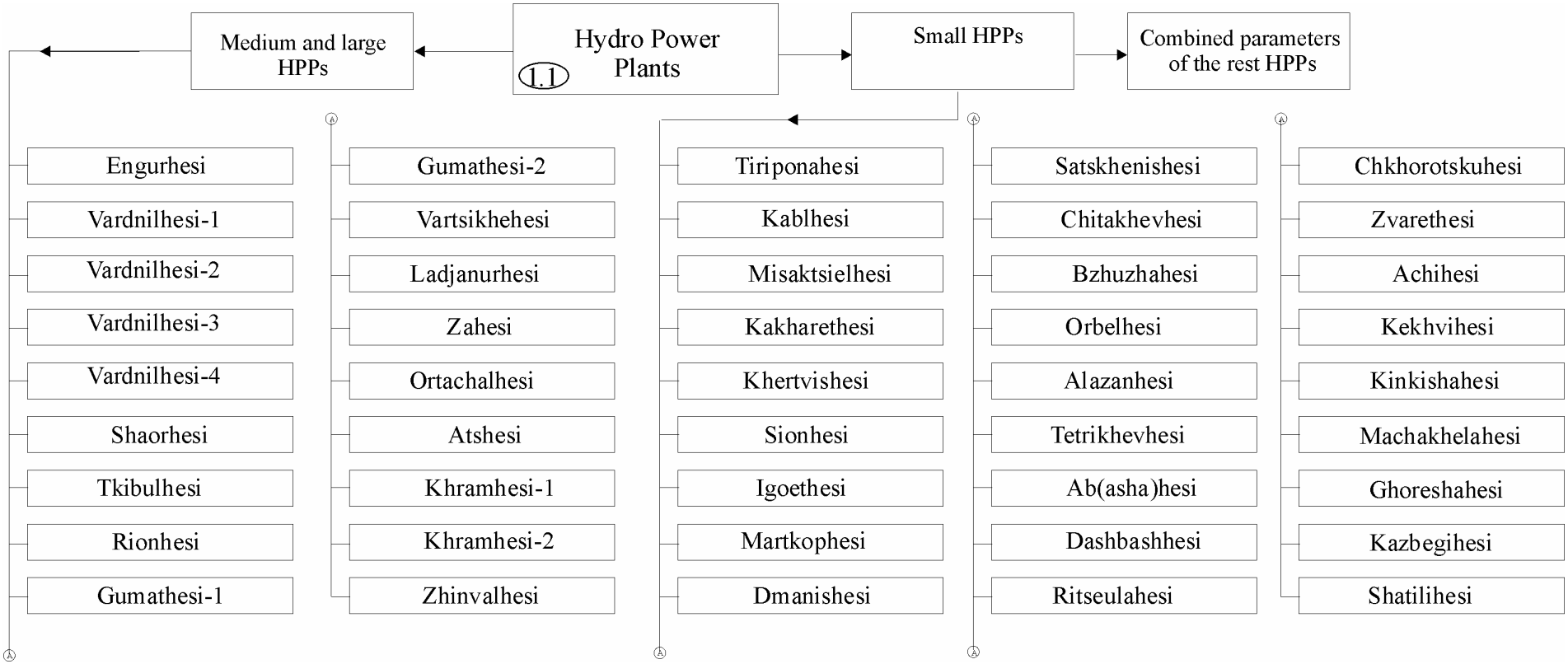
Cont. Table 23-2

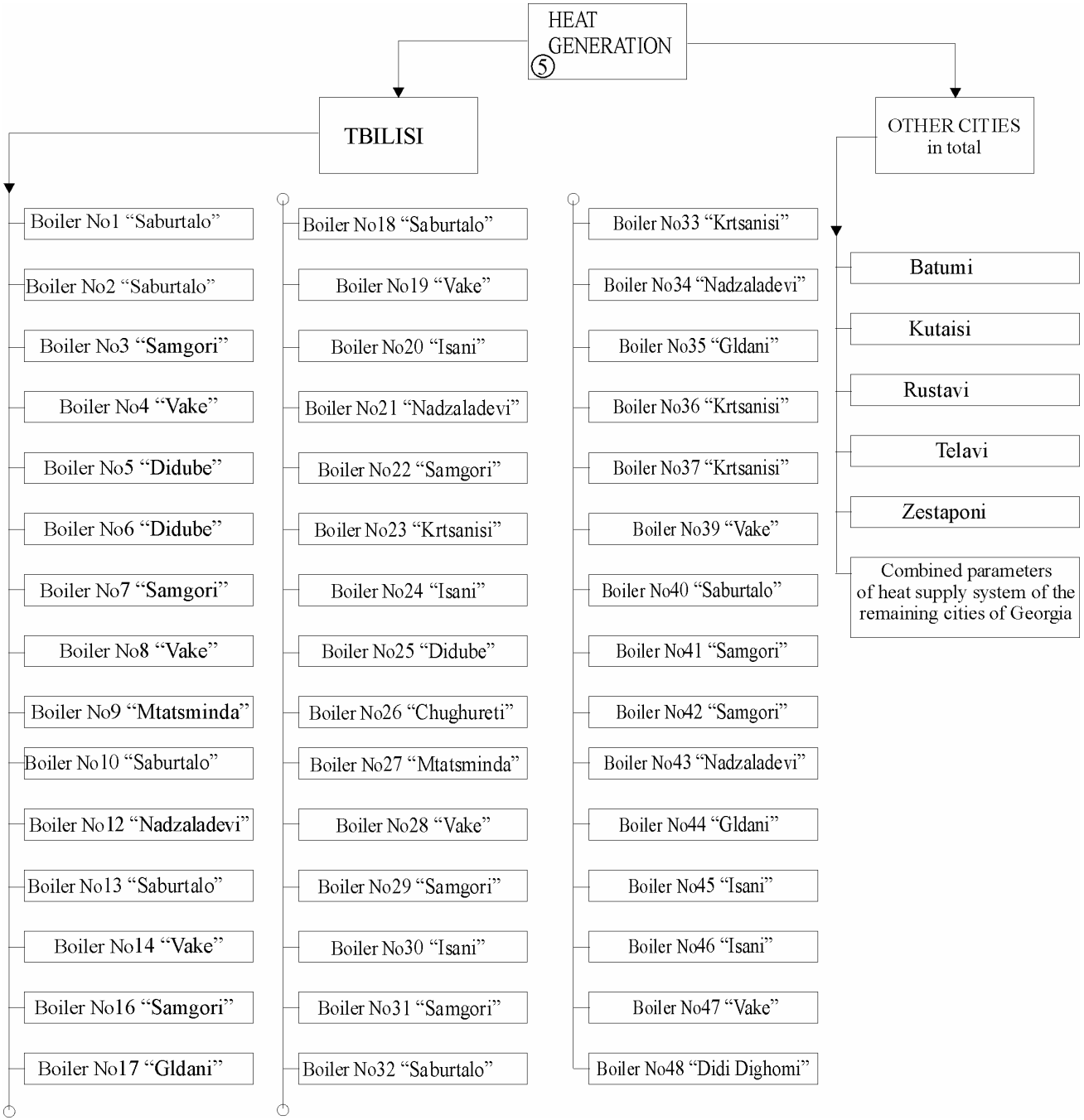
1	2		3	4	5	6	7	8	9	10	11	12	13
			24	145	11,83	2,67	14,51		30,74	45,25	81,6	18,4	100
			25	562,5	45,7	8,84	54,54		35,96	90,5	81,25	15,67	96,92
			26	45	3,94	0,26	4,2		5,8	10	87,64	5,16	92,8
			27	42,5	4,53	0,35	4,88		3,02	7,9	87,34	8,19	95,53
			28	177,5	14,38	2,09	16,43		45,47	61,9	81,04	11,76	92,8
			29	25	2,2	0,16	2,36		5,34	7,7	88,16	4,64	92,8
			30	112,5	9,16	2,9	12,06	0,58	12,64	25,3	81,46	25,78	107,24
			31	87,5	7,66	0,23	7,91		15,89	23,8	87,5	2,65	90,15
			32	32,5	2,78	0,23	3,02		21,11	24,13	85,66	7,14	92,8
			33	75	6,5	0,7	7,2		2,2	9,4	86,61	9,28	95,89
			34	15	0,65	0,01	0,66		5,34	6,6	85,07	0,77	85,84
			35	15	1,34	1,6	2,94	4,52	0,34	7,8	85,07	108,27	193,34
			36	275	22,39	3,13	25,51	1,51	20,18	47,2	81,41	11,39	92,8
			37	10,5	0,93	0,46	1,4		0	1,4	88,38	44,19	132,57
			39	40	1,69	0,81	2,49		1,51	4	87	20,3	107,3
			40	47,5	4,18	1,26	5,45	2,09	2,67	10,2	87,92	26,86	114,78
			41	67,5	5,92	0,69	6,61		21,46	28,1	87,64	10,31	97,95
			42	8,8	0,81	0,1	0,9		0	0,9	92,27	1,32	93,59
			43	95	8,24	3,25	11,5		80,5	92	86,69	34,19	120,88
			44	93,8	8,18	2,55	10,73	4,15	66,82	81,7	86,57	27,21	113,78
			45	67,5	5,92	1,74	7,64		51,16	58,8	87,64	25,78	113,42
			46	87,5	7,66	2,44	10,1		87,7	97,8	87,5	27,84	115,34
			47	125,01	10,11	0,95	11,06		21,34	32,4	80,74	7,42	88,16
			48	92,5	2,15	0,5	2,65		40,25	49,9	86,53	11,29	97,82
	Total in Tbilisi			5370,01	445,64	100,5	546,1	76,8	1273,08	1915,08	84,17	18,86	103,03
2	Boilers for the district heating system	Kutaisi	1 – 3	N.A.	N.A.	N.A.	N.A.	N.A.	192	190	N.A.	N.A.	N.A.
3		Rustavi	1 – 3	N.A.	N.A.	N.A.	N.A.	N.A.	215	215	N.A.	N.A.	N.A.
4		Batumi	1 – 3	N.A.	N.A.	N.A.	N.A.	N.A.	58	58	N.A.	N.A.	N.A.
5		Telavi	1 – 3	N.A.	N.A.	N.A.	N.A.	N.A.	42	42	N.A.	N.A.	N.A.
6		Zestaphoni	1 – 2	N.A.	N.A.	N.A.	N.A.	N.A.	11	11	N.A.	N.A.	N.A.
7	The Restr Cities of Georgia		1	N.A.	N.A.	N.A.	N.A.	N.A.	240	240	N.A.	N.A.	N.A.
8	**Total in Georgia**								2031,08	2671,08			

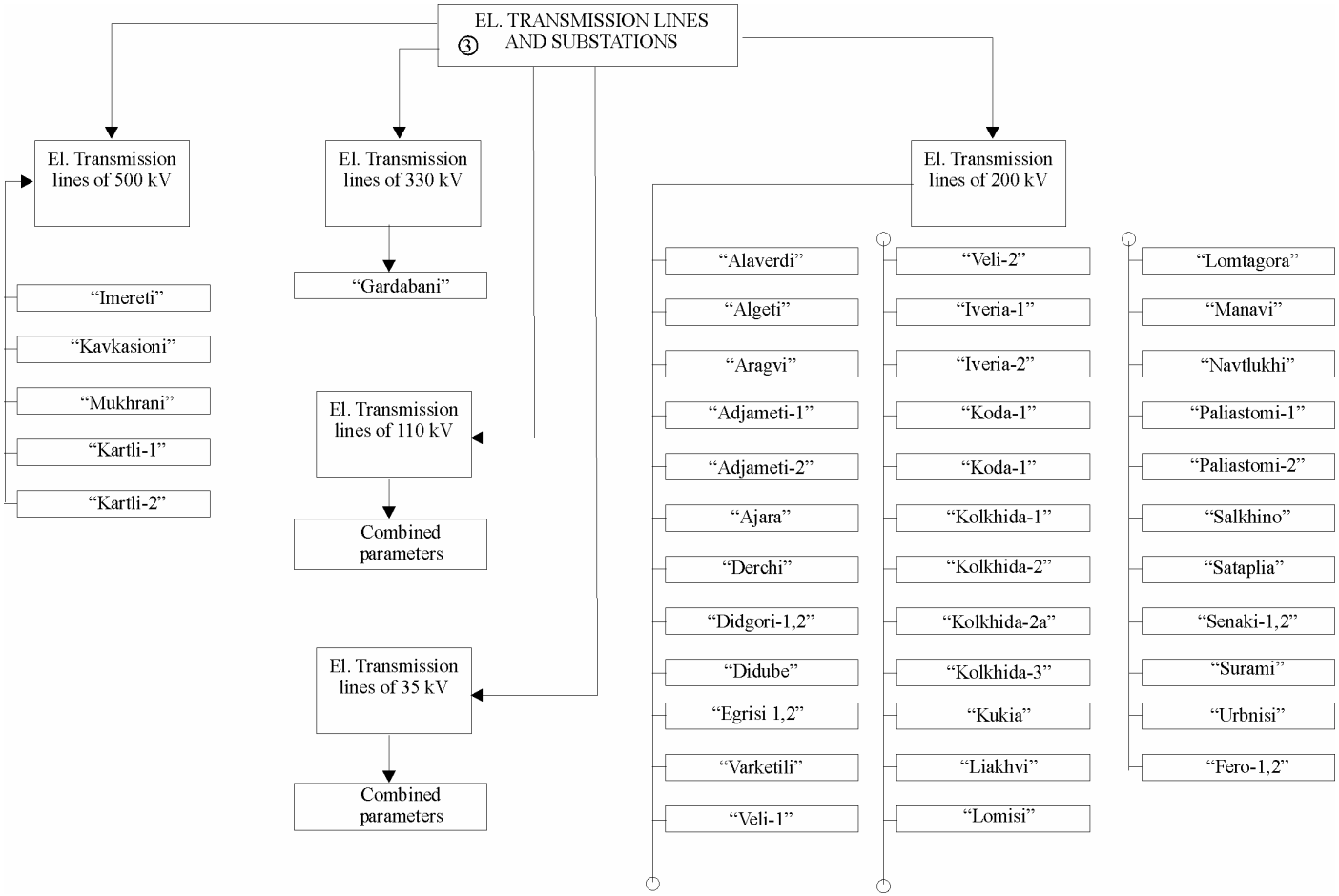
ANNEX A

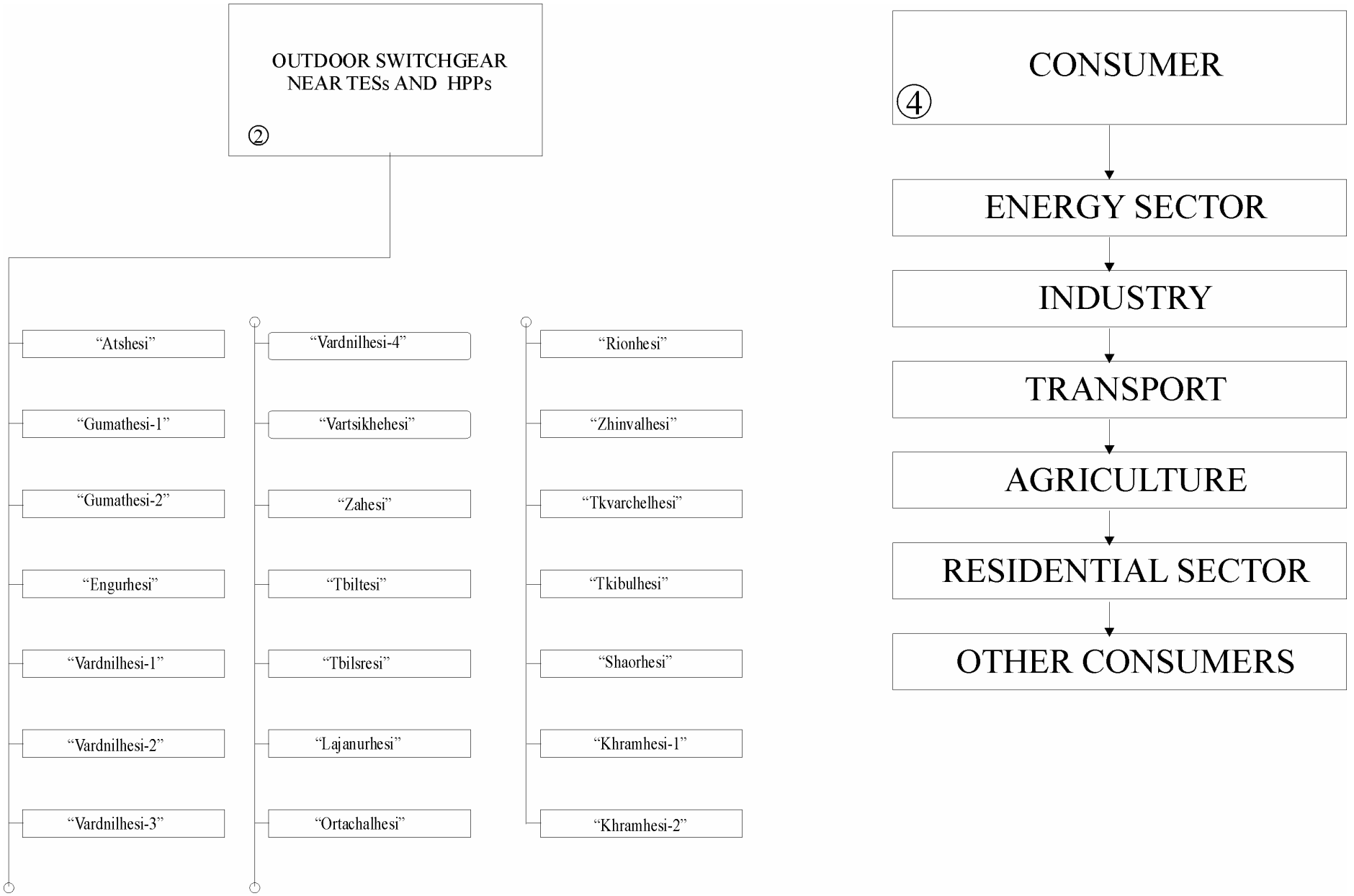

FUEL AND ENERGY COMPLEX
A
INDUSTRY
METALLURGY
TIMBER INDUSTRY
CONSTRUCTIONAL MATERIAL PRODUCTION
CHEMICAL INDUSTRY
FOOD INDUSTRY
Rustavi Metallurgical Plant
Zestaponi Ferroalloy Plant
Rustavi Cement Plant
Kaspi Cement Plant
Rustavi Chemicals Plant "Azoti"
Tbilisi Bakery Plant No4


A
FUEL and ENERGY COMPLEX
ENERGY SUPPLY
FUEL INDUSTRY
ELECTRIC-POWER INDUSTRY
HEAT SUPPLY
EXTRACTION ⑧
TRANSPOR-TATION ⑨
SALE ⑩
GENERATION ①
TRANSMISSION ②
DISTRIBUTION ③
CONSUMER ④
GENERATION ⑤
DISTRIBUTION ⑥
CONSUMER ⑦
THERMAL ELECTRIC PLANTS 1.2
HYDROPOWER PLANTS 1.1
Coal
Oil and natural gas
Transportation
THERMAL ELECTRIC STATIONS
CO-GENERATION
Tbilsresi
Tkvarchelsresi
Tbilisi CHP
"Aghmosavleti-2"mine named after E. Mindeli
Mine "Okriba" named after G. Tsulukidze
Imereti mine named after A. Dzidziguri
Tkvarcheli mines department -4 mines
Mine "Dasavleti"
"Kakhetis navtobi" Ltd
"Frontera I.J." Ltd
Georgian-British Oil Company, Ltd
"Ioris veli" Ltd
JSC "Saknavtobi"
Georgian-German Oil Company
JSC "Navtobtransi"
Georgian pipeline company
Georgian International Oil Corporation (GIOC)


Hydro Power Plants
1.1
Medium and large HPPs
Small HPPs
Combined parameters of the rest HPPs
Engurhesi
Vardnilhesi-1
Vardnilhesi-2
Vardnilhesi-3
Vardnilhesi-4
Shaorhesi
Tkibulhesi
Rionhesi
Gumathesi-1
Gumathesi-2
Vartsikhehesi
Ladjanurhesi
Zahesi
Ortachalhesi
Atshesi
Khramhesi-1
Khramhesi-2
Zhinvalhesi
Tiriponahesi
Kablhesi
Misaktsielhesi
Kakharethesi
Khertvishesi
Sionhesi
Igoethesi
Martkophesi
Dmanishesi
Satskhenishesi
Chitakhevhesi
Bzhuzhahesi
Orbelhesi
Alazanhesi
Tetrikhevhesi
Ab(asha)hesi
Dashbashhesi
Ritseulahesi
Chkhorotskuhesi
Zvarethesi
Achihesi
Kekhvihesi
Kinkishahesi
Machakhelahesi
Ghoreshahesi
Kazbegihesi
Shatilihesi


HEAT GENERATION
5
TBILISI
OTHER CITIES in total
Boiler No1 “Saburtalo”
Boiler No2 “Saburtalo”
Boiler No3 “Samgori”
Boiler No4 “Vake”
Boiler No5 “Didube”
Boiler No6 “Didube”
Boiler No7 “Samgori”
Boiler No8 “Vake”
Boiler No9 “Mtatsminda”
Boiler No10 “Saburtalo”
Boiler No12 “Nadzaladevi”
Boiler No13 “Saburtalo”
Boiler No14 “Vake”
Boiler No16 “Samgori”
Boiler No17 “Gldani”
Boiler No18 “Saburtalo”
Boiler No19 “Vake”
Boiler No20 “Isani”
Boiler No21 “Nadzaladevi”
Boiler No22 “Samgori”
Boiler No23 “Krtsanisi”
Boiler No24 “Isani”
Boiler No25 “Didube”
Boiler No26 “Chughureti”
Boiler No27 “Mtatsminda”
Boiler No28 “Vake”
Boiler No29 “Samgori”
Boiler No30 “Isani”
Boiler No31 “Samgori”
Boiler No32 “Saburtalo”
Boiler No33 “Krtsanisi”
Boiler No34 “Nadzaladevi”
Boiler No35 “Gldani”
Boiler No36 “Krtsanisi”
Boiler No37 “Krtsanisi”
Boiler No39 “Vake”
Boiler No40 “Saburtalo”
Boiler No41 “Samgori”
Boiler No42 “Samgori”
Boiler No43 “Nadzaladevi”
Boiler No44 “Gldani”
Boiler No45 “Isani”
Boiler No46 “Isani”
Boiler No47 “Vake”
Boiler No48 “Didi Dighomi”
Batumi
Kutaisi
Rustavi
Telavi
Zestaponi
Combined parameters of heat supply system of the remaining cities of Georgia


EL. TRANSMISSION LINES AND SUBSTATIONS
③
El. Transmission lines of 500 kV
"Imereti"
"Kavkasioni"
"Mukhrani"
"Kartli-1"
"Kartli-2"
El. Transmission lines of 330 kV
"Gardabani"
El. Transmission lines of 110 kV
Combined parameters
El. Transmission lines of 35 kV
Combined parameters
El. Transmission lines of 200 kV
"Alaverdi"
"Algeti"
"Aragvi"
"Adjameti-1"
"Adjameti-2"
"Ajara"
"Derchi"
"Didgori-1,2"
"Didube"
"Egrisi 1,2"
"Varketili"
"Veli-1"
"Veli-2"
"Iveria-1"
"Iveria-2"
"Koda-1"
"Koda-1"
"Kolkhida-1"
"Kolkhida-2"
"Kolkhida-2a"
"Kolkhida-3"
"Kukia"
"Liakhvi"
"Lomisi"
"Lomtagora"
"Manavi"
"Navtlukhi"
"Paliastomi-1"
"Paliastomi-2"
"Salkhino"
"Sataplia"
"Senaki-1,2"
"Surami"
"Urbnisi"
"Fero-1,2"


OUTDOOR SWITCHGEAR
NEAR TESs AND HPPs
②
"Atshesi"
"Gumathesi-1"
"Gumathesi-2"
"Engurhesi"
"Vardnilhesi-1"
"Vardnilhesi-2"
"Vardnilhesi-3"
"Vardnilhesi-4"
"Vartsikhehesi"
"Zahesi"
"Tbiltesi"
"Tbilsresi"
"Lajanurhesi"
"Ortachalhesi"
"Rionhesi"
"Zhinvalhesi"
"Tkvarchelhesi"
"Tkibulhesi"
"Shaorhesi"
"Khramhesi-1"
"Khramhesi-2"
CONSUMER
④
ENERGY SECTOR
INDUSTRY
TRANSPORT
AGRICULTURE
RESIDENTIAL SECTOR
OTHER CONSUMERS

ANNEX B

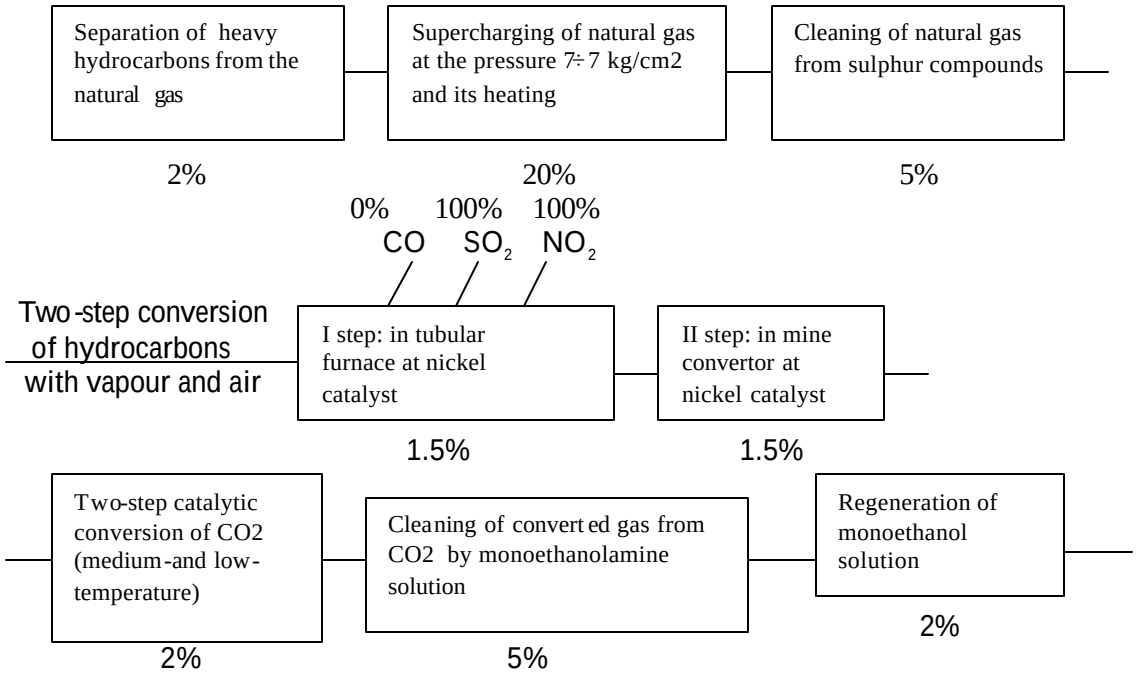
Short description of processes at the JSC "Azoti"

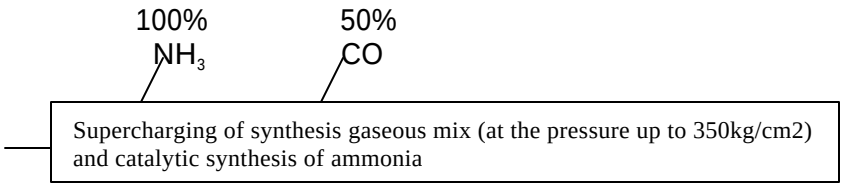
The pollution of atmospheric air by the enterprise is taking place by 3 different ways:

1. By the leakage of polluting substances from the main and auxilliary units and installations;
2. By the organized emissions from the special gas-air- and dust-transporting constructional systems for running air with harmful substances;
3. By the epysodic accidental fugitive emissions linked with the complete or partial failure of technological units and installations, or with the accidental disruption for different reasons of technological regimes.

1. Ammonia production (aggregate AM-600)

Ammonia is produced by the interaction of gaseous hydrogen and nitrogen (at the pressure of 320-350kg/cm^2 and 450-550^{0}C temperature) in the ammonia synthesis shop according to given below technological scheme. Here and further numbers below blocks show the relative consumption of electricity, and above the chemical symbols-the share of relevant substance in the emission, associated with the given step of examined technological process. The initial row materials are natural fuel gas (240 thousand t/y) and atmospheric nitrogen.





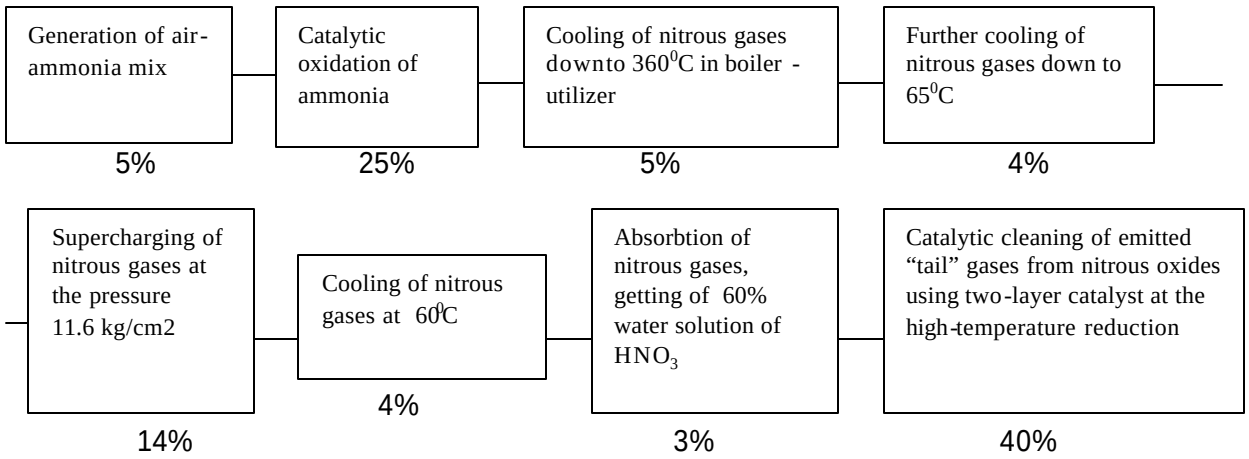
Permanent emissions in the atmosphere from the ammonia production are as follows:

1. Tubular gases coming out of tubular furnace that contain CO, SO_2 and NO_2;
2. Mixture of emitted gas, dust and air from the deflectors, coming out of turbocompressor, compressor and pumping stations;
3. Reservoir (so called tank) gases (for the production of ammonia water solution), supplied to the ammonia catching unit;
4. So called ventilation gases, coming out of ammonia synthesis aggregate and compressors.

Periodic emissions from the ammonia production consist of gases emitted from the gas synthesis units while starting and stopping of process, that are burned in torches by the duty burners being in constant readyness

2. Weak nitric acid production (aggregate AM-72)

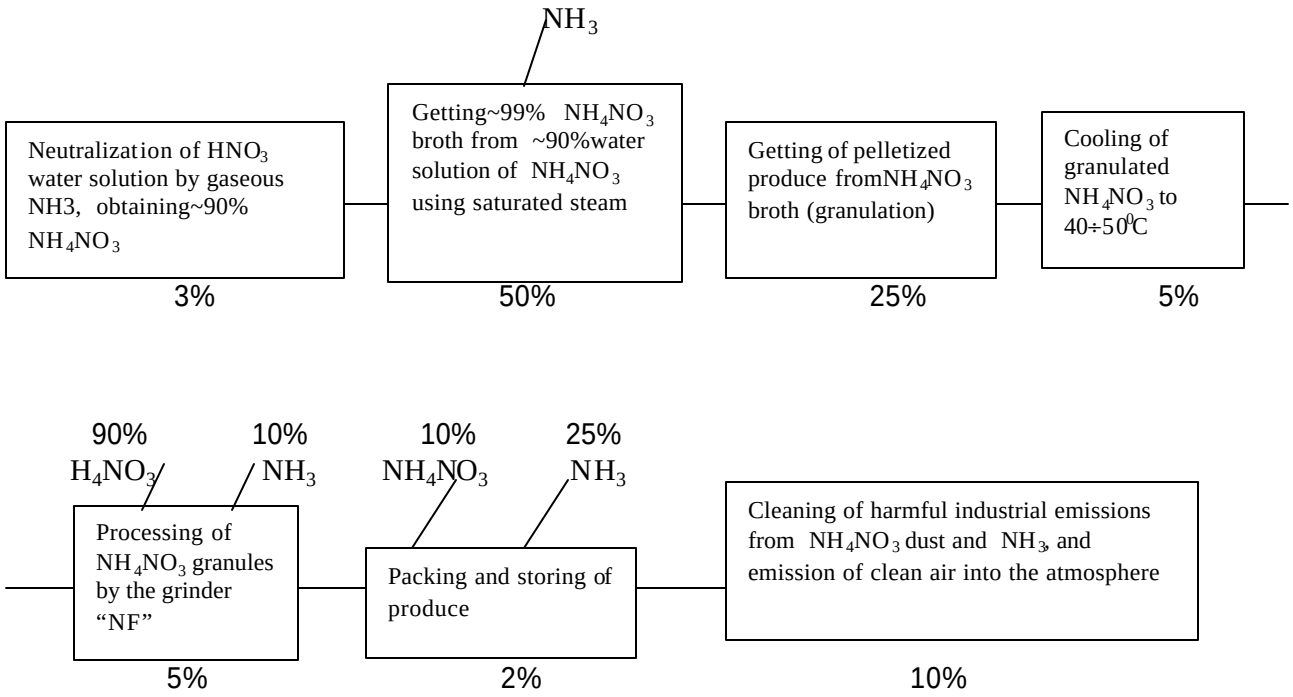
The production process is based upon the water absorbtion of nitric oxides obtained under the catalytic oxidation of ammonia. It is realized according to the technological scheme presented below.



From this production nitrous oxides are emitted into the atmosphere. The cleaning of passing gases from them is performed in the process of their reduction by natural gas in the reactor applying two-layer catalyst: first layer is APK-2, and the second– AL_2O_3.

3. Ammonia nitrate (nitramine) production (aggregate AG-72)

The nitramine production process is based on the interaction between ≈99% water solution of HNO_3 and gaseous ammonia, and it goes on according to the technological sheme given below:



For the decrease of air pollution from this production the ammonia containing air, coming out of evaporation device and nitramine granulating tower before the emission into the atmosphere is cleaned from nitramine dust and ammonia in the washing scruber by diluted acid solution of ammonia nitrate (which then is returned to the NH_4NO_3 production). This washing scruber contains 2 three-section blocks, each equipped with 3 sieve-like plates and netting-like spray-catcher.

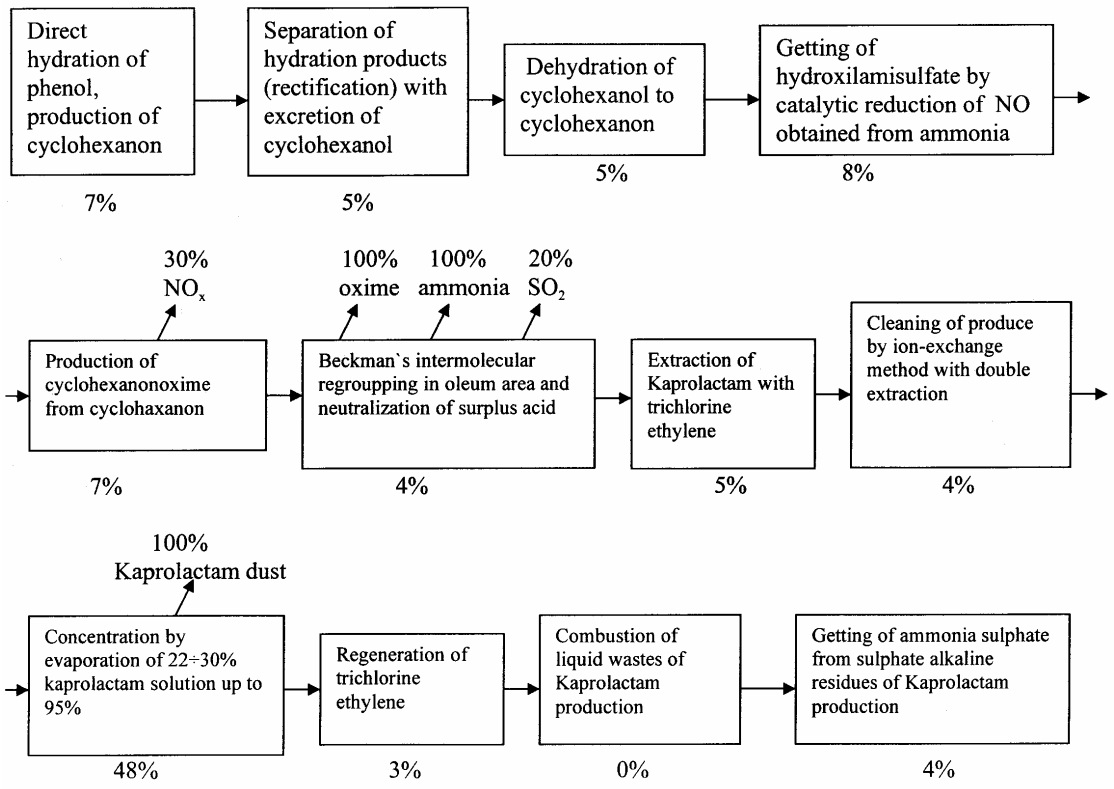
4. Kaprolactam production

The manufacture of Kaprolactam is carried out under the technological scheme presented below.

The harmful emissions from the Kaprolactam production are as follows:

1. Blow-off gases from the phenol hydration stage (to render harmless directed to torch combustion);
2. Nitrous gases from the hydroxilaminosulphate shop`s contact device, that are emitted while starting the production or the disruption of technological regime (they are rendered harmless by torch combustion in 15÷30 min.);
3. Nitrous gases escaped from the hydroxilaminosulphate generating reactor, that are also directed to torch combustion.

Gases containing ammonia sulphate dust after passing through the "boiling layer" dryer are being cleaned in the dry cyclone and scruber, where they are washed by ammonia sulphate water solution.

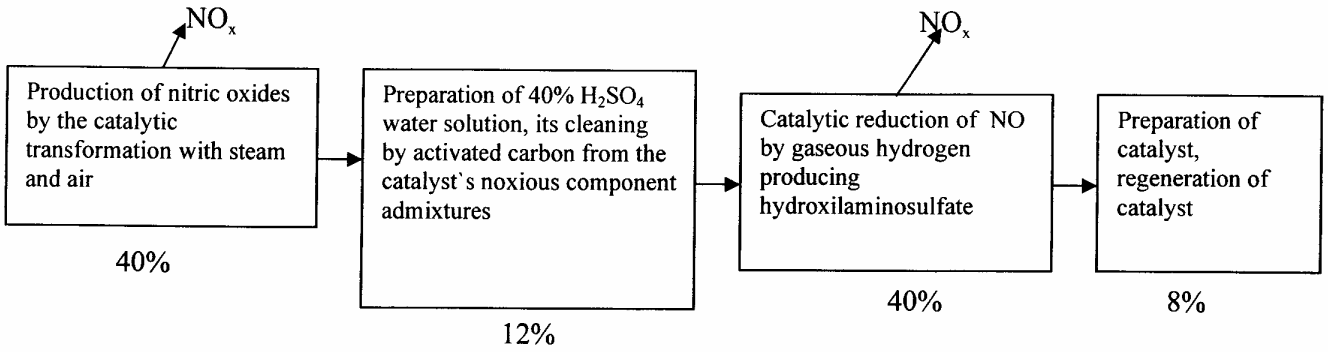


4.1. Cyclohexanon shop

While using catalyst by the one-step direct hydration of phenol at the temperature of 150-170^{0}C its hydration products are being obtained. By their rectification the separation of cyclohexanon from cyclohexanol is performed with primary getting of anon-recificate (afterwards by the dehydration of cyclohexanol once again cyclohexanon is obtained). Gases coming out of hydration stage to render them harmless are supplied to torch combustion, if they are not utilized for the reduction at the electrochemical manganese dioxide shop. According to the technological scheme, cyclohexanon (anon-rectificate) is supplied to the row lactam shop for the production of lactam. The anon-rectificate could be sent to customer as a final product. Cubic solutions obtained as a result of rectification are supplied to the dehydration stage to get additional rectificate by the above described scheme: cyclohexanol-cyclohexanon. Cubic solutions resulting from the dehydration are transferred to the Kaprolactam production waste combustion shop to render them harmless.

4.2. Hydroxilaminosulphate shop

The hydroxilaminosulphate shop produces sulphur acidic hydroxilamine according to the given below technological scheme:.



As it has been mentioned above, while putting into operation of contact installations for the production of nitric oxides or their stopping, nitric oxides are emitted in the atmosphere, and to render harmless they are combusted in the torch. The so called “tail gases” coming out of nitric oxides` catalytic reduction reactor are rendered harmless by the torch combustion as well.

The nitric acid condensate of 0.7÷3% concentration generated at the shop is transferred for the neutralization, and after being neutralized by ammonia is discharged into the sewerage, if it is no possibility to use this weak acid solution for the production of nitric acid.

4.3. Row lactam and Kaprolactam shops

By the oximation of cyclohexanon with hydroxilamine sulphate the cyclohexanonoxime is produced, and afterwards by so called Beckman`s intermolecolar regroupping in the oleum area Kaprolactam is generated (in the form of oily liquid), from which Kaprolactam is extracted by trichlorine ethylene with the double extraction method. Cubic wastes of these processes are diverted to the combustion shop to render them harmless.

At the Kaprolactam shop the 95% concentrated Kaprolactam is produced from the 22-30% Kaprolactam solution by the evaporation of water. At the crystal Kaprolactam department of Kaprolactam shop the wet catching device for the Kaprolactam dust was put into operation in 1992, where waste water solution was obtained and pumped to row lactam shop for the utilization. The remaining dust was emitted into the atmosphere.

4.4. Ammonia sulphate shop

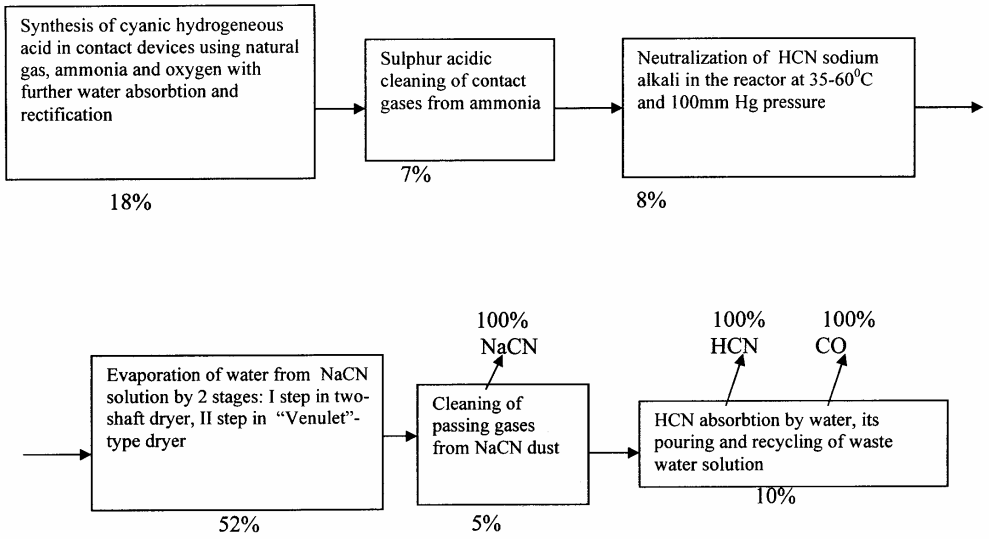
While carrying out main process at the row lactam shop, the 38-40% ammonia sulphate water solution is being produced, by processing of which in ammonia sulphate shop the fertalizer $(NH_4)_2SO_4$ is obtained through the implementation of following stages: evaporation, crystallization, processing in the centrifuge, drying of salt and packing. The air used for drying is cleaned from ammonia sulphate dust in the wet watering scruber and is discharged into the atmosphere.

4.5. Kaprolactam production waste`s combustion department

Rendering harmless of Kaprolactam production liquid wastes, containing harmful components, is performed at the waste combustion department in thermal cyclonic reactor-furnaces. Here toxic wastes are sprayed and burned together with natural gas keeping strictly to the necessary regime emitting the combustion products in the atmosphere.

5. Sodium cyanide production

Sodium cyanide is produced under the presented below technological scheme:



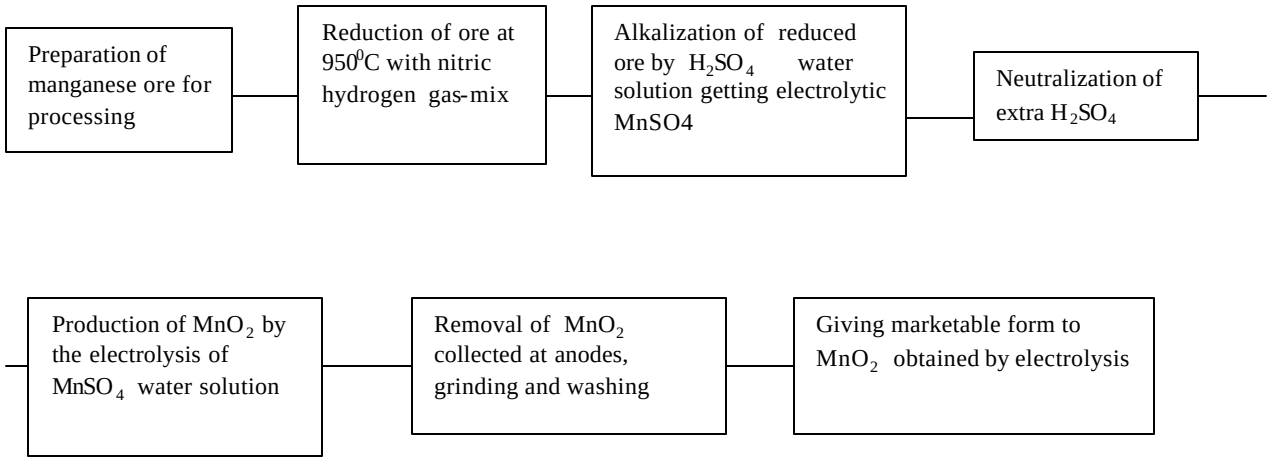
For the cleaning of exaust gases from NaCN dust the mixture of gas, dust and air coming out of dryer is supplied to two-section cyclone, where NaCN dust is sedimented. The cleaned air is further blown to the wetter, then to the "Venturi" scruber and "fog collector" of moistcather, where the NaCN dust is also captured, and afterwards for the final cleaning passing gases are supplied to the turbulent washing device. Refined by this way air is emitted into the atmosphere.

Thus, the permanent emissions from the NaCN production are:

1. Passing gases containing CO and HCN. According to the 1991-1992 atmospheric air protection plan the purification of passing gases from these components is provided by their torch combustion to the complete liquidation of CN ions, and reduction of CO content down to $2.5g/m^3$ concentration.
2. Air coming out of drying stage after the sedimentation of NaCN dust in the double cyclone and air from the local ventilation system containing harmful components. Both are refined in "Venturi" scruber by wet washing, then in turbulent washer and after this are disharged into the atmosphere.

6. Electrochemical manganese dioxide (EMD) production

The technological scheme of EMD production is given below:



At present the production of manganese dioxide is suspended and thus we do not present the detailed environmental review of this technological scheme.

Table 4.6. Total combined GHG (including SO2) and dust emissions from JSC "Azoti" main industrial units

½	Emitted substances	Related to electricity consumption		Due to fuels combustion in the boiler		From technological processes		Total combined emissions	
		1990	2000	1990	2000	1990	2000	1990	2000
1	CO_2, thousand t	187,860	33, 588	617,882	353.788	339.7755	236.24746	1145.5175	623.62346
2	Methane, t (equivalent to CO_2, t)	6,684 (140,364)	0,962 (20,202)	43.161 (906,38)	24.714 (518.994)	0	0	49.845 (1046.745)	25.676 (539.196)
3	N_2O, t (equivalent to CO_2, t)	1,373 (425,63)	0,160 (49,6)	1,1219755 (347,8124)	0.642 (199.02)	1784.4975 (553194.22)	1696.545 (525928.95)	1786.9924 (553967.64)	1697.347 (526177.57)
4	NO_X, t (equivalent to CO_2, t)	523,199 (20927,96)	91,4 (3656,0)	1553,78 (62151,2)	889.7 (35588)	331.05954 (13242.4)	302.158 (12086.321)	2408.0385 (96321.54)	1283.258 (51330.32)
5	CO, t (equivalent to CO_2, t)	45,235 (135,705)	9,728 (29.184)	3841.345 (11524.035)	2199.546 (6598.638)	2982.6483 (8947.9449)	1690.246 (5070.738)	6869.2283 (20607.684)	3899.52 (11698.56)
6	NMOVCs, t (equivalent to CO_2, t)	13.766 (151.426)	2.694 (29.634)	86.32696 (949.59656)	49.428 (543.708)	822.0375 (9042.4125)	520.498 (5725.478)	922.13046 (10143.435)	572.62 (6298.82)
7	Total CO_2 eq., thousand t	209.641	37,.3726	693.76102	397.236	924.20247	785.05893	1827.6043	1219.6678
8	SO_2, t	2.746	0.278	0.557+∑	0	76.7235	48.371	80.0265	48.649
9	Dust (from mazut combustion), t	5.492	0.556	15.0	0	0	0	20.492	0.556
10	Amonia saltpetre dust, t	0	0	0	0	159.7	154.3	159.7	154.3
11	Sodium cyanide dust, t	0	0	0	0	0.0022	0.0012	0.0022	0.0012

Table 4.7. JSC "Azoti" modernization measures financial economical and environmental effectiveness assessment

No	Modernization measure	Cost for measure realization, US $	Total financial and economical efficiency of the measure, US $/y	Environmental effect of carried out measures		
				Values of emission by the data of 2000, t/year	Values of emission after realizing the measures, t/year	Environmental effect financial profit, US $/year
1	In ammonia process–In ammonia synthesizing shop No2 aggregate capital repairs	1 500 000	2 400 000	CO_2-201 700.0; CO- 9.723; NO_2- 7.084.	CO_2-191 615.0; CO- 9.235; NO_2-6.73.	65.55; 0.48; 25.89; Total: 91.92.
2	In nitric acid shop-changing platinum nettings in contacting apparatus, K-31 absorbant column capital repairs, adding of a catalyst in P-40	1 000 000	1 200 000	NO_2-74.876; CO-15.837.	NO_2-72.406; CO-15.314.	180.62; 0.51; Total: 181.13
3	In ammonia process-in cooling shop-desorption of ammonia water	7670.0	36000	NH_3-181.0	NH_3-2.85	13 027.22
4	In ammonia process-in the ammonia synthesizing aggregate No2-overheating of steam by 20-30%.	15 523.5	2 073 600	CO_2-20962,38; CO- 87,835; NO_2- 37,216.	CO_2-0.0; CO- 0.0; NO_2- 0.0.	136.26; 85.64; 2721.42; Total: 2943.32
		Total: 2523202.5	Total: 5709600.0			Total effect: 16243.59
Note: Compensation time - 5,3 months						