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ELECTRICITY AND HEAT DEMAND PROJECTIONS FOR KRASNODAR KRAI AND NORTH CAUCASUS

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ABSTRACT

In the Scope of Work for this Contract CENEf was required to develop one scenario for electricity and heat demand for the North Caucasus UPS and Krasnodar Krai The base year will be 1993 Yearly demand projections will be developed for each economic sector (total and by consumption sector industry transportation agricultural and residential/commercial) and for each year between 1995 and 2010 CENEf's demand scenarios will incorporate the potential for inter-energy substitutions, particularly for space heating and hot water e g when centralized heat might be displaced by direct fuel use or electricity

Model simulation of future growth of electricity and heat demand in North Caucasus and Krasnodar Krai shows that electricity demand will go up to 49 7-58 3 bln kWh in North Caucasus and to 13 2 15 billion kWh in Krasnodar Krai in the year 2000 and correspondingly to 58 4 77 1 billion kWh and 16 - 26 billion kWh in 2010 This range of uncertainty allows room for additional generation of local electric power to substitute imported electricity replace obsolete facilities and satisfy growing demand

Heat demand will grow up to 76 9-93 9 million Gcal in North Caucasus and 18 8-22 3 million GCal in Krasnodar Krai in the year 2000 and correspondingly 91,9-124 2 million Gcal and 22 5-29 Gcal in the year 2010 It will approach the 1990 level in 2004 in North Caucasus and in 2010 in Krasnodar Krai

Such relatively large range of the projections uncertainty results from the uncertainty with the future economic development as well as from data shortage for the model calibration It seems that this range covers all trajectories of future electricity and heat demand evolution foreseeable in North Caucasus and Krasnodar Krai for the coming 15 years

ELECTRICITY AND HEAT DEMAND PROJECTIONS

for

NORTH CAUCASUS

and

KRASNODAR KRAI

1. Historical Economic and Energy Data

1.1 Macroeconomic Data

Russia has begun a transition to democracy and a market system First signs of market economics are beginning to take shape Economic measures, such as price reform and privatization, resulted in a semiblance of market-type activity The painful transition process to a market economy is actually a combination of several simultaneous transitions

- the monopolistic, top-down government is under transformation into a bottom-up system of regional authority and decision-making;
- the centrally planned system must be recast for the economy to develop market based interactions, emphasis on military production and heavy industry is shifted towards consumer goods and light industry,
- isolationism is giving way to international trade and participation in foreign markets

It is a challenge to predict the future of any country, especially a country in transition, but in Russia it is even a greater challenge to collect reliable and consistent data necessary for a proper discription of the past

The process of statistical data collection is also in transition Russia only recently switched to the National Accounts system As a result, data for GDP structure became available only since 1990 But for regions GDP data are still unavailable Energy data for the Federation as well as for regions are still collected according to the standards of the past However, the statistical discipline is much below the former standards

When the depth of economic crisis is evaluated, reliability of statistical data must be taken into account So as to escape heavy taxes significant volumes of production are not statistically reported by enterprises This turns the clear picture of statistical description of the recent years to misty general images of real objects

1 1 1 North Caucasus

North Caucasus as a region includes nine so-called subjects of the Russian Federation Therefore, data collection for North Caucasus (NC) is a more complicated process than that for a separate region like Krasnodar Krai There are several reasons for that·

- data for North Caucasus (NC) are to be aggregated from the statistical data for nine different regons;
- lack of data on specific indicator for one region does not allow to estimate this index for the whole of NC,
- inconsistency of statistical data taken from different sources for any specific region is aggravated when nine regions are considered,
- there is no NC region administration which requires timely statistical data collection and presentation

As a result, we have much less detailed historical economic and energy statistical data on NC than on Krasnodar Krai It was almost impossible to get additional statistical information during the project implementation just due to the shortage of time against the background of time intensity of the data collection and verification task

One data collection trip to the region was made But it provided additional information mainly for Krasnodar Krai For North Caucasus data provided by HBI, Russian Federation statistical offices and those provided by individual experts were used

Basic macroecomonic indicators for North Caucasus which we managed to collect are shown in the Table 1

Table 1. North Caucasus General Economic Indicators

	Units	1990	1991	1992	1993	1994
Population	10^3	16890	17030	17246	17292	17518
urban	10^3	9597	9823	9900	9828	9830
rural	10^3	7154	7207	7346	7564	7688
Industrial Production Index*	1990=1 00	100 100	97 97 4	78 77 8	66 58 1	
Fixed Capital Investments	1990=1 00	100	88 5	68	52 6	
Agricultural production	1990=1 00	100			72	
Consumer Price Index**	1990=1	1	2 16	37.24	379 46	1745 7
Average Salary	1990=1	1	1 79	16 28	153 0	

* The upper number was taken from [8] with no specification of the base year, the number below was taken from the VNIIKTEP expert

** Data for consumer price index is average for the Russian Federation

Several observations could be made based on the analysis of numbers presented

- 11 8 percent of Russians are living in the region,
- NC population is growing very rapidly by 0 9 percent per year against the background of stable Russian population,
- 44 percent of local population lived in rural areas in 1994, in early 90 s rural population grew by 1 8 percent per year,

- NC economy is coming through a very deep ecomonic crisis - industrial production in 1990-1993 declined by 34 percent, and gross fixed capital investments by 47 percent,
- grain production was relatively stable, some decline in agricultural production was due to the reduction of meat, as well as fruit and vegetables production,
- real incomes of NC population declined substantially, thus limiting the market for many goods and services

1.1.2. Krasnodar Krai

More than a quarter of NC population are living in Krasnodar Krai There are different estimates of Krasnodar Krai population For 1993 three numbers are provided by different sources 4,940 thousand people for all population living in the region, 4,819 thousand people for permanent population by the end of the year (those two estimates are taken from regional statistics), and 1,879 annual average population (data from the federal statistical source [8]) While population in the Russian Federation was stable in 1990 1994 there was a dynamic growth in Krasnodar Krai by 1,3 percent per year In addition to that, the share of rural population is very substantial - about 46 percent and even growing, it grew by 0 4 percent in 1990 1994 - which was a very unusual trend

Presently, Krasnodar Krai, as well as North Caucasus and the rest of Russia, is a Crisisland (see Table 2)

- industrial production declined by 42 percent,
- capital investments in 1994 were just one third of the 1990 level,
- agricultural production in 1994 was 34 percent below the 1990 level,
- consumer price index grew 1,000 fold, whereas average salaries just 616 fold

Table 2 Krasnodar Krai General Economic Indicators

	Units	1990	1991	1992	1993	1994
Population	10^3	4680	4738	4797	4879	4940
urban	10^3	2549	2587	2612	2649	2672
rural	10^3	2131	2151	2185	2230	2268
Industrial Production Index*	1990=100	100 100	99 99 5	82 90 8	73 81 1	58 66 1
Fixed Capital Investments	1990=100	100	89	73	81	35
Agricultural production	1990=100	100	89	76	79	66
Index of industrial wholesale prices	1990=1	1	3 72	107 1	1074 8	3467 3
Consumer Price Index	1990=1	261	489	4896	45628	160800
Average Salary	1990=1	1	1 9	18 8	174 8	616 1

* The upper number was taken from [8] with no specification of the base year, the number below was taken from the Krai statistical office and presents constant 1994 prices

1 2 Industrial sector

1 2 1 Russian Indusry in the Transition

Russian industrial sector is undergoing a very deep crisis in 1994 the index of industrial production was just half of the 1990 level and two thirds of the 1980 level Many simultaneous transitions are under way within the sector:

- in 1994 the share of government owned industrial enterprises declined from 52 to 30 percent, whereas the share of enterprises with mixed property grew from 39 to 61 percent, and the share of private enterprises grew from 7 to 9 percent,
- purchasing power became a number one factor driving the structural changes of Russian industrial sector,
- contribution to overall industrial output of competitive (on international markets) industries grew against the background of diminishing role of machinery and light industry,
- lack of energy and resources conservation technologies is partly responsible for making industrial structure heavier,
- more than 70 percent of enterprises have expired debts

1 2 2 North Caucasus

Although information on physical indices of industrial output evolution in the region by branches of industry is very limited, some available data are presented in Table 3 This Table illustrates how deep the industrial crisis is, especially in such industries as chemical, light, fuels production and ferrous metals production Two industries machinery and food processing - contribute to more than a half of overall industrial production with food alone providing more than one third of the industrial output Therefore, the NC industry is much less energy intensive compared to many other Russia's regions

Electricity generation and fuels production are two other major industries, followed by chemical industry and building materials Lack of data on physical indices expressed in monetary terms to illustrate the structural shifts within the industry was partly overcome by illustrations of producton declines of representative products by industries (See Table 4) The data presented confirm the depth of the economic crisis in the industriasl sector of NC

Table 3 North Caucasus Industrial Indicators in 1990-1994

	Share in 1993	1990	1993
Industrial Production	100 0	100	66
Electricity Generation	10 8	100	86
Fuels Production	6 8	100	54
Iron and Steel	3 0	100	58
Non-Ferrous	2 9	100	78
Chemical	7 5	100	41
Machinery	17 5	100	51
Pulp and Paper	3 3	100	63
Building Materials	6 5	100	65
Light	5 4	100	52
Food	34 5	100	64
Other	1 8	100	N/A

Table 4 Basic Industrial Production in the North Caucasus

	Units	1990	1993	1994	1994/1990(%)
Electricity	bln kWh	58 8	51 5	49 1	83 6
Oil	mln t	8 6	6 1	6 1	70 9
Steel	mln.t	1 32	0 97	0 88	66 7
Metal Cutting Machines	units	6326	1811	1651	26.1
Plastics	th t	348	230	198	56 9
Sawed Wood	th m3	1880	753	528	28 1
Reinforced Concrete	mln.m3	6 05	3.09	3 04	50 2
Sugar	th t	1706	1249	n a	73.2*

*) 1993/1990

Source' Data for 1990 and 1993 were taken from [8], 1994 values are VNIIKTEP estimations

1.2 3 Krasnodar Krai

Because of unequality of price growth by industries the depth of economic crisis in Krasnodar Krai industry measured in constant prices depends on the base year for the industrial output evaluation in constant prices or on the methodology of physical index calculation By any scale the decline is very substantial

The structure of the industrial output in Krasnodar Krai differs even more substantially from many other Russian regions than that of the NC with food industry dominance (see Table 5). Energy intensive industries, such as ferrous and non-ferrous metallurgy and chemical industry, all together contributed just 2 1 percent of the total industial output for Krasnodar Krai Power generation industry ranked second in the list of most important industries followed by building materials, machinery, and fuel extraction industry

Decline by industries was very uneven the least decline was in the power sector (6 percent), whereas chemical industry output fell down 5 fold

Table 5 Krasnodar Krai Industrial Indicators in 1990-1994

	Share in 1994	1990	1991	1992	1993	1994
Industrial Production	100 0	100	99	82	73	58
Electricity Generation		100	101	97	93	94
Fuels Production	7 8	100	113	90	93	89
Iron and Steel	0 1	100	107	61	46	35
Non-Ferrous	0 0	100	107	61	30	20
Chemical	2 0	100	72	48	33	20
Machinery	9 2	100	90	75	57	22
Pulp and Paper	4 0	100	104	89	74	36
Building Materials	9.5	100	97	78	64	51
Light	3 4	100	108	72	62	33
Food	41 3	100	86	71	64	52
Other	7 0	100	93	82	73	58

1 3 Residential Sector

1 3 1 North Caucasus

Major characteristics of NC building stock are shown in Table 6 Analysis of data presented shows the following:

- saturation of living area per capita in NC is close to the average number for the Russian Federation;
- in 1990-1994 there was a minor improvement in living conditions of NC population,
- construction of new houses declined by 41 percent in 1990 1993,
- 51 percent of population are living in single, or two-three families private houses,
- 41 percent of tenants live in apartments,
- the share of 5-storeyed and higher rise houses is very limited - less than 1 percent,
- a substantial part of houses were private even before the economic reforms started, and presently 73 percent of dwellings are private,
- given more than 50 percent of people living in private single-family houses, price elasticity of energy demand in this sector should be above average for the Russian Federation,
- district heating is provided to 44 percent of dwellings,
- hot water is supplied to 30 percent of all dwellings,
- natural gas is supplied to 76 percent of dwellings,
- on floor electric ranges are available only for 2 percent of dwellings.

Table 6 North Caucasus Major Characteristics of Residential Sector

	Units	1990	1993	1994
Population	10^3	16890	17292	17518
Living area/cap	m^2	16 1	16 2	16 4
Living area	$10^6 m^4$	235	276	282
New construction	$10^6 m^2$	6 102	3 65	N/A
Share of 5-storeyed and higher houses	%			0.6
Characteristics of urban building stock				
water supply	%	na	55	57
canalization	%	na	45	48
central heating	%	na	41	44
hot water	%	na	30	30
gas	%	na	76	76
electric range	%	na	2	2

1 3 2 Krasnodar Krai

A high share of rural population predetermines the dominance of private houses in the residential sector - a very unusual situation for Russia's regions Major characteristics of this sector are shown in Table 7 Analysis of data presented shows

- statistical saturation of living area per capita in Krasnodar Krai is not far from the average for NC and the Russian Federation, but there are some differences in various sources on this index,
- in 1990-1994 living conditions of Krasnodar Krai population did not improve,
- construction of new houses declined, but not as much as other ecomonic activities,
- percent of Krasnodar Krai population live in private houses;
- less than forty percent of tenants live in apartments,
- the share of 5-storeyed and higher houses is very limited - less than 1 percent,
- presently about three forths of dwellings are private,
- district heating is provided to 68 percent of urban dwellings and to about 40 percent of all dwellings,
- hot water is supplied to 48 percent of urban dwellings and to 29 percent of all dwellings,
- on floor electric ranges are available only for 4 percent of urban dwellings and there is substantial room for electricity to substitute natural gas Many families have on-table electric ranges. We have no data on saturation of these devices, but we can estimate that 26 percent of families use electric devices either on-floor or on-table The crucial factor in competition between gas and electricity will be relative energy prices

Table 7 Krasnodar Krai: Major Characteristics of Residential Sector

	Units	1990	1991	1992	1993	1994
Population	10^3	4680	4738	4797	4879	4940
Living area/cap	m^2	16 3	16 0	16 2	16 4	16 4
Living area	$10^6 m^2$	76 8	75 8	77 7	80 0	80 8
New construction	$10^6 m^2$	1 49	1 21	1 0	1 2	1 2
Heating	%	100	100	100	100	100
fuel	%	65	59	56	56	54
district heating	%	30	36	39	39	41
electricity	%	5	5	5	5	5
Hot water	%	100	100	100	100	100
fuel	%	64	64	64	61	61
district heating	%	26	26	26	29	29
electricity	%	10	10	10	10	10
Cooking	%	100	100	100	100	100
fuel	%	74	74	74	74	74
electricity	%	26	26	26	26	26
Private dwellings	%	62	63	66	73	73
urban	%	44	45	47	56	56
rural	%	80	81	86	92	92
Share of 5 storeyed and higher houses	%					0 6
Characteristics of urban building stock						
water supply	%	69	70	69	70	69
canalization	%	59	65	66	65	66
control heating	%	59	56	67	68	68
hot water	%	42	48	48	48	48
gas	%	67	75	75	75	75
electric range	%	4	4	4	4	4

1 4 Energy Balance

1 4 1 North Caucasus

The task requires to determine electricity and heat demand for major energy consuming sectors, with incorporation for inter energy substitution considerations To implement this task energy balance for the regions were reconstructed from all sources of information available for CENEf This balance is presented in Table 8

North Caucasus energy statistics in 1994 is neither complete nor reliable Data availability for North Caucasus which is agreggated data by regions always lagged comparing with separate regions Lack of data for Chechnya since 1993 is an additional problem This is why 1993 values were used as a base year in our calculations for NC.

Substantial additional data collection is requred to improve the quality of the results

Data presented in Table 8 allows to specify several important observations

- NC is net importer of energy It is self sufficient only as far as coal is concerned and even exports this energy resource, but substantially depends on natural gas export (in 1994 local gas production covered only 15 percent of local consumption), gasoline (49%), diesel fuel (59%), mazut (70%), electricity (93%),
- growth of primary energy consumption (PEC) in 1985-1990 was very moderate just 5%,
- in 1990-1993 PEC decline (19%) was below that in overall economic activity (about 34%),
- by energy consumption sector this decline was distributed in the following way (in brackets there is the share of the sector in final energy consumption in 1990)·
  - * industry and construction -33% (25%)
  - * agriculture +1 5% (11%)
  - * transport 28% (16%)
  - * residential and commercial 5 4% (38%)
  - * other -38% (9%),
- growth in agricultural sector and very small decline in residential and commercial sectors as well as in the energy sector itself prevented PEC from deeper reduction

- NC has a very unusual for Russia structure of final energy consumption by sectors - residential and commertial sector dominates over industrial one,

The structure of final energy consumption by fuels in 1990 was as follows (in brackets there are data for 1993)

* coal	7 1%	(6 9%)
* gas	30 2%	(28 8%)
* petroleum products	28 4 0%	(28 2%)
* electricity	10 8%	(11.8%)
* district heating	23 6%	(24 3%)

Table 8 North Caucasus Energy Balance

th tce

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
INDIGENOUS PRODUCTION	1985	21177 1	8659 5	5544 3	6172 7	10803 8		560 6			52918 0
	1990	19611 5	6402 1	4601 1	8555 0	7809 0		894 5			47873 2
	1991	13164 8	6129 5	4733 7	8004 7	8831 0		749 1			41612 9
	1992	12622 0	5876 5	4288 2	5827 6	7124 0		744 0			36482 3
	1993	12079 1	5405 0	2696 9	5075 0	4726 5		847 3			30329 8
	1994	10450 4	5175 0	2294 6	2856 5	4041 5		735 5			25553 6
IMPORTS	1985	1884 5	44664 9	5776 7	7337 0	8015 9			1121 9		68800 8
	1990	339 0	69844 1	5691 8	4654 5				926 2		81455 9
	1991			1759 7	3921 8				5494 0		11175 5
	1992			1400 6	1596 5				484 7		3481 7
	1993			1095 2	1203 5				4366 1		6664 7
	1994			2373 6	1986 5				158 7		4518 7
EXPORTS	1985	14254 4	11350 5	5332 7	3523 5	4944 3			412 5		39818 0
	1990	10253 4	22375 6	3576 0	5626 0				373 6		42204 6
	1991				4386 5				4752 7		9139 3
	1992										
	1993								3869 3		3869 3
	1994										
Saldo	1985										
	1990					1644 0					1644 0
	1991	6060 1	35037 1			1033 0					30009 6
	1992	5198 4	32901 5			959 0					28662 1
	1993	-4851 7	30524 5			2561 9					28234 7
	1994	3485 1	28733 9			1749 5					25998 3
STOCK CHANGES	1985	1128 5	9936 0	59 6	30 5	-164 4					-9001 0
	1990	2455 9	-9671 5								12127 4
	1991		n a								
	1992		n a								
	1993		n a								
	1994		n a								
TOTAL PRIMARY ENERGY SUPPLY	1985	9935 7	32037 9	5928 7	10016 6	13711 0		560 6	709 3		72899 7
	1990	7241 6	44199 1	6716 9	7583 5	9453 0		894 5	552 6		76641 1
	1991	7104 4	41166 6	6493 4	7540 0	9864 0		749 1	741 3		73658 8
	1992	7423 6	38778 0	5688 8	7424 0	8083 0		744 0	484 7		68626 1
	1993	7227 4	35929 5	3792 1	6278 5	7288 4		847 3	496 7		61859 9
	1994	6965 3	33908 9	4668 2	4843 0	5791 0		735 5	158 7		57070 6

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	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
ELECTR GENERATION	1985	2911 8	4448 3	3 0	-269 8	-7501 2		-560 6	6287 4		-9407 3
	1990	3179 6	9171 6	-3 0	59 5	3924 8		-394 5	7227 0		10005 9
	1991	2960 7	8014 8		105 9	4305 7		-749 1	7041 0		9094 6
	1992	3487 1	8098 8		-78 3	-3572 3		-744 0	6707 1		9273 8
	1993	3407 4	7692 0		-64 7	3486 4		-850 2	6334 9		-9165 8
	1994	3364 7	7022 0		-47 8	3101 3		-735 5	6042 7		8228 6
CHP Plants	1985	-509 0	2498 0		13 0	-2234 0				4335 5	-918 5
	1990	231 0	3958 0			-925 0				4226 1	887 9
	1991	-198 0	-3928 0			-914 0				4107 0	-933 0
	1992	-169 6	-3334 5			-907 6				3572 1	839 6
	1993	-79 2	-3118 0		0 6	-720 9				3174 6	744 1
	1994	-69 0	-2983 0		1 5	-299 0				2978 4	374 1
DISTRICT HEATING	1985	-534 1	-7840 7	-1 5	103 0	1308 4				8800 4	987 2
	1990	-389 5	9225 3	-1 5	-33 4	1190 5				10145 9	694 3
	1991	348 8	8589 4		-78 3	1124 8				9532 8	608 5
	1992	-302 0	8092 0		-45 0	-697 3				8587 9	548 4
	1993	-281 6	8103 4		31 9	-738 4				8629 9	525 4
	1994	270 1	8000 0		27 6	500 1					8797 7
Waste Heat Recovery Units	1985									575 6	575 6
	1990									384 1	384 1
	1991									332 8	332 8
	1992									290 1	290 1
	1993									264 7	264 7
	1994										
OWN USE & LOSSES	1985	-100 0	2019 4	-23 8		-12 3			-1246 1	-247 4	3649 1
	1990	-100 0	3186 7	-26 8		-5 5			-1294 6	-204 8	4818 3
	1991	-100 0	2973 9	-25 3		5 5			-1248 9	-190 2	4543 8
	1992	-100 0	2870 4	23 8		4 1			-1219 8	-182 3	4400 5
	1993	-100 0	2916 4	20 9		4 1			-1192 2	-170 2	4403 8
	1994	-100 0	2842 8	16 4					-1057 3		4016 5

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
TOTAL FINAL CONSUMPTION	1985	5880 7	14367 0	5840 8	9630 9	2655 1			5892 0	13464 0	57730 5
	1990	4398 0	18657 6	6784 0	7215 2	3514 1			6653 2	14551 3	61773 3
	1991	3497 5	17660 6	6468 1	7357 3	3514 1			6695 3	13782 3	58975 1
	1992	3364 5	16381 8	5665 0	7300 8	2901 7			6097 6	12267 8	53979 0
	1993	3359 1	14100 2	5261 2	6181 4	2338 6			5756 2	1899 0	48895 6
	1994	3161 6	13241 1	4651 8	4766 2	1890 1			5144 1		32854 8
INDUSTRY TOTAL	1985	358 3	4666 7	156 5	683 0	1041 2			2815 3	8239 7	17960 5
	1990	227 3	5121 0	120 7	532 2	783 6			3085 1	8186 3	8056 2
	1991	182 5	4478 1	105 8	510 4	634 3			2979 6	7681 2	16572 0
	1992	135 0	3640 9	93 9	411 8	474 0			2581 8	6775 9	14113 4
	1993	117 4	2628 9	79 0	314 7	474 0			2207 9	6286 0	12107 8
	1994	90 3	2214.9	46 2	262 5	379 5			2161 2		5154 5
Fuel	1985	14 3	575 0	1 5	1 5	268 5			457 4	1122 6	2440 7
	1990	4 1	694 6	4 5	17 4	239 8			441 2	966 4	2367 8
	1991	3 4	668 2		14 5	169 9			400 4	963 8	2220 1
	1992	2 0	626 8			93 2			361 6	892 3	1975 9
	1993	1 4	372 6			60 3			281 4	829 4	1545 0
	1994	0 7	350 8			34 3					385 7
Iron & Steel	1985		509 5	1 5	4 4	132 9			67 6	115 8	831 6
	1990		537 1	1 5	7 3	109 6			77 1	146 0	878 5
	1991		527 9		7 3	101 4			72 5	128 1	837 1
	1992		331 2			89 1			68 2	104 4	592 9
	1993		254 2			87 7			55 0	85 2	482 0
	1994		210 5			82 2					292 7
Non-Ferrous Metals	1985		128 8	3 0	8 7	1 4			265 8	164 5	572 1
	1990		112 7		11 6				272 5	166 5	563 2
	1991		107 0		11 6				296 4	150 9	565 8
	1992		96 6						210 1	107 3	414 0
	1993		89 7						196 4	90 7	376 7
	1994		79 4								79 4

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
Chemical and Petrochemical	1985	0 7	435 9	1 5	1 5	126 0			452 6	2047 8	3065 9
	1990	0 7	294 4			116 5			501 6	1924 8	2837 9
	1991	0 7	250 7			94 5			472 6	1826 1	2644 7
	1992	0 7	208 2			69 9			382 4	1544 4	2205 5
	1993	0 7	131 1			90 4			315 4	1472 9	2010 5
	1994	0 7	95 5			78 1					174 2
Machinery	1985	16 0	456 6	10 4	16 0	20 6			541 5	430 0	2491 3
	1990	5 4	426 7	17 9	8 7	34 3			609 9	483 1	2585 9
	1991	3 4	370 3		7 3	24 7			573 7	1387 1	2366 4
	1992	2 0	328 9			20 6			530 7	1172 6	2054 8
	1993	2 0	256 5			17 8			446 1	1008 2	1730 5
	1994	1 4	202 4			13 7					217 5
Wood Paper Pulp & Printing	1985		39 7	3 0	14 5	9 6			64 8	348 9	480 4
	1990		69 0	3 0	8 7	8 2			73 4	341 2	503 5
	1991		62 1		7 3	5 5			68 6	330 3	473 7
	1992		52 9			4 1			60 3	306 0	423 3
	1993		44 9			4 1			49 2	277 4	375 6
	1994		34 5			2 7					37 2
Constructive Materials	1985	219 2	2072 3	10 4	52 2	397 3			247 8	772 2	3771 4
	1990	165 6	2248 3	4 5	26 1	197 3			262 2	788 9	3692 8
	1991	133 0	1867 6		20 3	165 8			245 3	724 3	3156 2
	1992	99 1	1427 2			131 5			207 9	559 1	2524 7
	1993	85 5	976 4			142 5			175 5	600 6	1980 4
	1994	65 1	790 1			113 7					968 9
Construction	1985	13 6	32 2	114 7	403 1	21 9			141 4	171 6	898 5
	1990	4 1	42 6	89 4	288 6	20 6			168 2	145 9	759 2
	1991	4 1	40 3	80 5	277 0	21 9			161 9	141 7	727 2
	1992	3 4	38 0	73 0	221 9	19 2			125 7	135 0	616 0
	1993	2 7	34 5	62 6	172 6	16 4			107 0	128 4	524 2
	1994	1 4	32 2	35 8	139 2	12 3			87 2		308 1

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
Textile & Leather	1985	6 8	10 4	1 5	2 9				132 8	307 5	461 7
	1990		5 8						133 4	345 5	484 6
	1991		5 8						130 4	307 5	443 6
	1992		4 6						91 5	293 3	389 3
	1993		2 5						76 0	191 6	271 1
	1994		2 3								2 3
Food and Tobacco	1985	82 1	247 8	6 0	165 3	54 8			237 7	1568 7	2362 4
	1990	46 1	378 4		162 4	52 1			275 5	1704 7	2619 1
	1991	37 3	343 9		163 9	46 6			264 6	1550 1	2406 3
	1992	27 8	301 3			42 5			241 5	1397 1	2010 3
	1993	25 1	258 8			52 1			218 4	1458 6	2012 9
	1994	21 0	240 4			41 1					302 5
Other	1985	5 4	158 7	3 0	13 1	8 2			206 0	190 2	584 6
	1990	1 4	311 7		1 5	5 5			270 0	173 5	763 4
	1991	0 7	234 6		1 5	4 1			293 3	171 3	705 4
	1992		225 4			4 1			301 9	164 5	695 9
	1993		207 0			2 7			287 6	143 0	640 4
	1994		177 1			1 4					178 5
TRANSPORT	1985	40 7	1 2	4872 3	2940 6	1097 4			610 1	195 9	9758 1
	1990	17 6	2 3	5039 2	4068 7	1075 5			596 9	264 6	11064 7
	1991	14 3	4 6	4611 6	4106 4	1102 9			538 5	259 5	10637 7
	1992	11 5	4 6	3818 9	3655 5	1082 3			466 3	256 0	9295 0
	1993	9 5	4 6	3440 4	3103 0	757 6			452 4	236 0	8003 4
	1994	6 1	3 5	3219 9	2916 0	561 7			441 1		7148 2

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
Agriculture	1985	122 1	213 9	327 8	2702 8	49 3			898 4	637 8	4952 2
	1990	51 6	120 8	309 9	2291 0	1085 0			981 8	623 5	5463 5
	1991	40 0	131 1	424 7	2398 3	1109 7			1058 4	609 2	5771 3
	1992	33 3	143 8	448 5	2717 3	1041 2			1135 0	584 9	6104 5
	1993	27 8	161 0	439 6	2402 7	835 7			1113 5	566 3	5546 5
	1994	19 0	143 8	403 8	1403 6	753 5			834 8		3558 5
Resid/Comm & Public Services	1985	4434 0	6238 8	417 2	274 1	223 3			1426 8	3956 8	16970 9
	1990	3961 7	7642 9	1192 0	136 3	128 8			1821 2	4756 2	19639 0
	1991	3183 3	7824 6	1215 8	146 5	258 9			1957 0	4573 1	19159 3
	1992	3128 3	7797 0	1253 1	342 2	243 9			1788 9	4062 6	18616 0
	1993	3150 1	7544 0	1209 9	229 1	201 4			1875 5	4360 4	18570 3
	1994	3019 8	7464 7	905 9	121 8	147 4			1707 0		13366 5
Non-specified sectors	1985	833 3	138 0	67 1	3030 5	48 0				433 9	4550 7
	1990	71 3	124 2	122 2	187 1	53 4				720 7	1278 8
	1991	27 1	104 7	110 3	195 8	30 1				659 2	1127 2
	1992	21 0	92 0	50 7	174 0	16 4				588 4	942 6
	1993	30 5	81 7	92 4	132 0	28 8				450 5	815 7
	1994	13 6	79 4	76 0	62 4	19 2					250 4
NON ENERGY USE	1985	92 3	3108 5			195 9					3396 7
	1990	68 5	5646 5			387 7					6102 7
	1991	50 2	5117 5			378 1					5545 8
	1992	34 6	4704 0			43 8					4782 4
	1993	23 8	3680 0			41 1					3744 9
	1994	12 9	3335 0			28 8					3376 7

Energy production in NC in recent years is declining by all energy carriers (see Table 9) Electricity production declined in 1990 1994 by 16 percent, heat generation - by 18% (in 1990-1993), mazut production - by 48%, diesel fuel by 67%, gasoline by 50%, coal by 47%, oil production by 56%, natural gas - by 19%

Specific balances for electricity and heat are presented in Tables 10 and 11

Electricity consumption fell down by 20% in 1990-1994 By sectors in 1994 (in brackets numbers for 1990) it is distributed in the following way (in percent)·

- industry 33.5 (37 5),
- construction 1 4 (2 2),
- agriculture 13 5 (12.6),
- transport 7 1 (7 7),
- residential and commercial 27 5 (23 4),
- own use 5 0 (4 8),
- losses 12 0 (11 8)

Major decline in electricity consumption was caused by construction (48%) and industrial (28%) sectors followed by transport (26%), agriculture (15%), and residential and commercial (6%).

Industrial sector dominates heat consumption Its share declined from 54 5% in 1990 to 51% in 1993, but is still very high Oveall heat consumption in 1985-1990 grew by 7.6 percent, but then declined by 18 percent in 1990 1993 Decline in the industrial sector was the major driving force for overall heat consumption decline Against this background the volume of heat consumption in the second largest heat consuming sector -residential and commercial - grew by 7 percent.

Substantial additional data collection should be done to improve the quality of the data presented for North Caucasus

1 4 2 Krasnodar Krai

Data presented in Table 12 allows to specify several important observations

- there was no substantial primary energy consumption PEC growth in Krasnodar Krai in 1985-1990 (only 1 6%),
- in 1990 1994 PEC decline (17%) was much below that in overall economic activity,
- by energy consumption sector this decline was distributed in the following way (in brackets there is the share of the sector in final energy consumption in 1990)

  * industry and construction 38% (29%)
  * agriculture 23% (7%)
  * transport 27% (28%)
  * residential and commercial 2% (30%)
  * other 56% (6%),

- very small decline in residential and commercial sectors and in energy sector itself prevented PEC from deeper reduction

Table 9 Energy production in the North Caucasus Region

	1985	1990	1991	1992	1993	1994
Electricity mln kWth	51117	58756	57243 9	54529	51503	49128
of which hydro	4558	7272	6090	6049	6889	5980
Heat, mln Gcal	95 884	103 189	97 71	87 064	84 4	n a
Oil and Gas Condensate mln t	10 807	8 628	7 93	7 057	6 1	3 8
Mazut, th t	7886	5700	6446	5200	3450	2950
Diesel Fuel th t	4257	5900	5521	4019	3500	1970
Gasoline th t	3721	3098	3177	2878	1810	1540
Coal th t	31 207	28 9	19 4	18 6	17 8	15 4
Natural Gas bln m3	7 53	5 567	5 33	5 11	4 7	4 5

Table 10 Electricity Consumption in the North Caucasus Region

mln kWth

	1975	1980	1985	1990	1991	1992	1993	1994
Total Consumption	39124 5	49195 9	56884 4	63248 3	63270 9	58469 5	55621 5	50418
1 Industry	16554	19403 9	21739 4	23714 4	22908 2	19968 7	17080 8	16862
Fuel industry	2731 6	3635 2	3718 7	3586 7	3255 2	2939 8	2287 6	
Ferrous metalurgy	476 2	518 1	549 5	627 2	589 6	554 7	446 8	
Non-ferrous metalurgy	1887 2	1970 9	2160 8	2215 4	2410	1708 3	1596 6	
Chemical and perochemical	3007	3148 3	3680	4078 3	3842 6	3108 6	2564 2	
Machinery	3188 1	3864 3	4402 6	4958 8	4664	4315	3626 5	
Wood, Pulp and Paper	483 7	490 3	526 7	597	557 6	490 2	400	
Building materials	1647 7	1791 3	2014 3	2131 5	1994	1690 3	1426 9	
Light industry	893	1035	1079 4	1084 6	1060	743 5	618 2	
Food industry	1554 2	1656 1	1932 2	2239 5	2151	1963 8	1775 6	
other industry	685 3	1294 4	1675 2	2195 4	2384 2	2454 5	2338 4	
2 Construction	739 8	1259 7	1149 5	1367 8	1315 9	1021 6	869 7	709
3 Agriculture	4168	5937 6	7304 3	7982	8604 7	9227 4	9052 5	6787 3
4 Transport	3341 1	4330 3	4960	4852 7	4378 1	3790 7	3677 7	3586
5 Residential and commercial	7618 8	10188 5	11600 2	14806 5	15910 6	14543 8	15248	13877 7
Total final consumption	32421 7	41120	46753 4	52723 4	53117 5	48552 2	45928 7	41822
Power sector - own use	2189 3	2519 9	2880	3041 6	3063 1	2986 4	2751 3	2517
Electricity losses	4513 5	5556	7251	7483 3	7090 3	6930 9	6941 5	6079

Table 11 Heat Consumption in the North Caucasus Region

th Gcal

	1985	1990	1991	1992	1993	1994
Generation						
CHP Plants	30318	29553	28720	24980	22200	20828
District Heating	61541	70950	66663	60055	60349	n a
Waste Heat Recovery Units	3991	2650	2300	2010	1840	n a
Electric Boilers and Others	34	36	27	19	11	n a
Total	95884	103189	97710	87064	84400	n a
Consumption						n a
1 Industry	56420	56227	52724	46440	43060	n a
Fuel Industry	7850	6758	6740	6240	5800	n a
Ferrous metalurgy	810	1021	896	730	596	n a
Non ferrous metalurgy	1150	1164	1055	750	634	n a
Chemical and perochemical	14320	13460	12770	10800	10300	n a
Machinery	10000	1037	9700	8200	7050	n a
Wood Pulp and Paper	2440	2386	2310	2140	1940	n a
Building materials	5400	5517	5065	4603	4200	n a
Light industry	2150	2416	2150	2051	1340	n a
Food industry	10970	11921	10840	9770	10200	n a
other industry	1330	1213	1198	1150	1000	n a
2 Agriculture	4460	4360	4260	4090	3960	n a
3 Transport	1370	1850	1815	1790	1650	n a
4 Construction	1200	1020	991	944	898	n a
5 Other	3034	5040	4610	4115	3150	n a
6 Residential and commercial	27670	33260	31980	28410	30492	n a
Total final consumption	94154	101757	96380	85789	83210	n a
Losses	1730	1432	1330	1275	1190	n a
Total Consumption	95884	103189	97710	87064	84400	n a

Table 12 Krasnodarsky Krai Energy Balance th.tce

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
INDIGENOUS PRODUCTION	1985		3416 6	1633 0	1053 4	1911 7	672 1	60 8			8747 6
	1990		2472 7	917 8	2005 5	1692 6	735 7	52 2			7876 6
	199		2188 8	438	740 5	323 3	385 0	45 4			4121 1
	1992		1618 8	397 8	675 C	298 0	243 0	61 5			3294 1
	1993		1981 3	289	515 5	645 2	241 9	47 4			3720 4
	1994		1938 C	253 3	461 9	336 7	230 0	41 2			3261 1
IMPORTS	1985	1403 3	13151 0	4367 2	5226 9	1835 7	660 0				26644 2
	1990	1016 5	7939 0	3985 8	3868 0	2130 7	1025 0		1958 8		21923 8
	1991	944 6	7615 2	1941 5	1583 9	2293 1	578 0		1922 4		16878 7
	1992	787 2	8971 8	1732 9	1673 3	2090 5	541 0		1635 1		17431 7
	1993	668 4	7822 7	1573 4	1376 8	1378 0	384 0		1514 7		14718 0
	1994	536 1	7638 0	1564 5	1266 5	1423 4	125 0		843 0		13396 5
EXPORTS	1985		8224 0	3704 1	3301 8	165 4	183 0				15578 3
	1990		943 9	2494 3	3242 2	1054 9	718 0		663 8		9117 2
	1991						77 0		749 9		826 9
	1992						51 0		569 3		620 3
	1993						54 3		449 6		503 9
	1994						64 8				64 8
Saldo	1985								1242 2		1242 2
	1990										
	1991										
	1992										
	1993										
	1994										
STOCK CHANGES	1985	82 8	-452 6	-93 9	28 3	-117 7					-553 1
	1990	11 5		56 6	-101 3	64 1					30 9
	1991										
	1992										
	1993										
	1994										
TOTAL PRIMARY ENERGY SUPPLY	1985	1486 1	7891 1	2202 2	3006 8	3464 3	1149 1	60 8	1242 2		20502 5
	1990	1028 1	9467 7	2466 0	2530 0	2832 5	1042 7	52 2	1295 0		20714 1
	1991	944 6	9804 0	2379 5	2324 4	2616 4	886	45 4	1172 6		20172 9
	1992	787 2	10590 6	2130 7	2348 2	2388 5	733	61 5	1065 7		20105 4
	1993	668 4	9804 0	1862 5	1892 3	2023 1	571 6	47 4	1065 1		17934 5
	1994	536 1	9576 0	1817 8	1728 4	1760 1	290 2	41 2	843 0		16592 9

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
ELECTR GENERATION	1985		1298 0	-3 0	29 8	-980 0		60 8	820 9		-1550 6
	1990		1414 0		55 1	-401 0		52 2	851 1		-1071 2
	1991		1430 0		43 2	-391 0			850 7		1013 5
	1992		1511 0		44 7	-389 0			812 5		-1132 2
	1993		1613 0		32 8	-314 6		47 4	780 3		-1227 6
	1994		1704 0		26 8	-245 0		41 2	759 9		-1257 1
CHP Plants	1985		928 4			-304 4				1051 5	-181 3
	1990		1251 3			-172 7				1215 5	-208 5
	1991		1249 0			81 3				1134 0	-196 3
	1992		1185 1			55 0				1059 6	-180 5
	1993		-998 7			40 0				886 6	-152 1
	1994		827 9			30 7				732 9	-125 7
DISTRICT HEATING	1985	112 6	2004 1	-1 5	64 1	-488 7	-64 4			2434 4	301 0
	1990	-43 4	-2151 2		-3 0	-447 0				2605 2	39 4
	1991	-38 0	-2360 9		-3 0	-454 5				2597 7	-258 6
	1992	-32 6	-2804 4		-1 5	-436 6				2407 8	-867 2
	1993	-26 5	-2770 2		-3 0	-405 3				2270 1	-934 8
	1994		-2690 4		-3 0	-388 9				1977 0	-1105 3
Waste Heat Recovery Units	1985									92 7	92 7
	1990									240 2	240 2
	1991									167 6	167 6
	1992									143 0	143 0
	1993									120 8	120 8
	1994									87 2	87 2
OWN USE & LOSSES	1985	-1 4	116 3	6 0					246 6	-101 7	471 9
	1990		-68 4	-4 5					277 7	-121 3	471 8
	1991		-70 7	4 5					224 9	-115 1	-415 2
	1992		-77 5	4 5					208 4	-106 5	-396 9
	1993		-68 4	3 0					224 7	-91 5	-387 6
	1994		62 7	-3 0					195 2	-78 7	-339 5

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
TOTAL FINAL CONSUMPTION	1985	1510 6	3544 3	2147 1	2913 0	1691 2	1085 2		1844 0	3476 9	18212 1
	1990	1072 9	4545 2	2449 6	2471 9	1811 8	1042 2		1911 6	3939 9	19245 1
	1991	986 7	4693 4	2361 7	2278 2	1689 7	885 7		1835 9	3794 2	18525 4
	1992	819 1	5010 3	2115 8	2302 1	1507 9	733 3		1688 4	3503 9	17680 8
	1993	690 1	4353 7	1849 1	1856 5	1263 2	571 6		1638 6	3186 0	15408 8
	1994	574 1	4291 0	1808 9	1700 1	1095 6	290 2		1468 8	2718 4	13947 1
INDUSTRY TOTAL	1985	259 9	1662 1		283 1	132 6	2 7		689 2	2108 7	5138 3
	1990	165 6	1912 9		217 5	171 4			700 5	2163 2	5331 1
	1991	151 3	1761 3		186 3	144 5			581 4	2076 1	4900 8
	1992	122 8	1545 8		168 4	132 3			522 6	1779 3	4271 3
	1993	92 3	1292 8		140 [illegible]	112 9			469 0	1522 4	3629 [illegible]
	1994	73 3	1327 0		123 7	97 3			384 5	1287 9	3293 5
Fuel	1985	138 4	287 3			23 8			9 7	153 6	612 9
	1990	88 2	19[illegible] 5			13 4			43 7	168 7	505 6
	1991	80 1	172 1			10 4			40 3	171 3	474 3
	1992	64 5	166 4			10 4			38 8	137 3	417 4
	1993	48 2	150 5			8 9			39 6	117 3	364 5
	1994	38 0	153 9			6 0			35 1	93 8	326 7
Iron & Steel	1985								1 4	1 1	2 5
	1990		66 1			1 5			0 5	28 3	96 4
	1991		45 6			1 5			0 3	26 6	74 0
	1992		38 8			0 9			0 4	21 6	61 7
	1993		31 9			0 4			0 2	16 9	49 4
	1994		25 1			0 4				14 7	40 3
Non-Ferrous Metals	1985										
	1990										
	1991										
	1992								0 1		0 1
	1993								0 1		0 1
	1994								0 0		0 0

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
Chemical and Petrochemical	1985		36 5						69 9	337 2	443 5
	1990		12 5			16 4			55 9	297 6	382 4
	1991		8 0			11 9			54 4	275 1	349 5
	1992		8 0			9 2			45 1	223 1	285 4
	1993		5 7			6 0			37 1	193 3	242 1
	1994		5 7			4 5			30 0	149 0	189 2
Machinery	1985	4	51 3		6 0				92 3	198 5	352 1
	1990	2 7	58 1		6 0	1 5			96 1	179 5	343 9
	1991	2 0	52 4		6 0	1 5			83 8	171 7	317 5
	1992	1 0	45 8		4 5	1 5			57 2	140 4	250 1
	1993	0 7	36 5		3 0	0 7			41 3	109 4	191 6
	1994	0 7	33 1		3 0	0 7			36 0	92 1	165 6
Wood Paper Pulp & Printing	1985		37 6		11 9	7 5			41 2	201 1	299 3
	1990	0 7	53 6		6 0	8 9			46 8	204 9	320 9
	1991	0 4	46 7		6 0	7 5			28 3	198 1	286 9
	1992	0 3	41 0		4 5	7 5			24 2	178 2	255 6
	1993		34 2		3 0	6 0			21 1	138 0	202 2
	1994		28 5		3 0	4 5			28 1	122 8	186 9
Constructive Materials	1985	61 1	1105 8		10 4	76 0			123 6	257 5	1634 5
	1990	58 4	1203 8		7 5	82 0			129 2	212 4	1693 1
	1991	54 3	1151 4		6 0	70 0			118 0	209 1	1608 8
	1992	45 5	982 7		6 0	65 6			109 3	173 0	1382 0
	1993	34 6	806 0		4 5	59 6			101 6	164 5	1170 7
	1994	28 5	859 6		3 0	55 1			93 0	133 1	1172 3
Construction	1985	2 0	11 4		120 7	6 0			27 6	14 6	182 2
	1990	2 0	17 1		90 9	6 0			43 2	42 3	201 5
	1991	2 0	14 8		73 0	6 0			37 5	38 8	172 0
	1992	1 4	13 7		61 1	4 5			18 6	37 6	136 8
	1993	1 0	11 4		52 2	4 5			17 9	30 9	117 8
	1994	0 7	8 0		46 2	3 0			24 0	26 3	108 2

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
Textile & Leather	1985	3 4	9 1						42 7	115 4	170 6
	1990		4 6						39 9	83 9	128 4
	1991		4 6						36 0	71 2	111 7
	1992		4 6						22 5	51 5	78 5
	1993		3 4						18 8	44 0	66 3
	1994		3 4						11 7	35 9	51 0
Food and Tobacco	1985	46 8	93 5		122 2	19 4			101 2	778 3	1161 4
	1990	12 9	247 4		104 3	41 7			140 9	868 7	1415 9
	1991	11 8	225 7		92 4	35 8			124 2	847 7	1337 6
	1992	9 6	209 8		90 9	32 8			118 0	773 1	1234 1
	1993	7 1	176 7		77 5	26 8			109 5	679 3	1076 8
	1994	4 8	182 4		68 5	23 1			105 8	592 6	977 2
Other	1985	4 1	29 6		11 9		2 7		179 7	51 3	279 4
	1990	0 7	58 1		3 0				104 5	76 8	243 1
	1991	0 7	39 9		3 0				58 4	66 5	168 5
	1992	0 7	35 3		1 5				88 4	43 6	169 6
	1993	0 7	36 5						81 8	28 9	147 9
	1994	0 7	27 4						20 7	27 5	76 2
TRANSPORT	1985	17 0	10 3	1820 8	1157 7	1178 6	1082 5		187 3	26 0	5480 2
	1990	10 9	2 3	1937 0	1622 6	1189 0	1042 2		238 2	100 7	6142 8
	1991	8 8	4 6	1683 4	1534 7	1159 2	885 7		225 3	101 8	5803 5
	1992	6 1	4 6	1713 5	1601 8	1037 0	733 3		226 0	98 7	5420 9
	1993	4 1	4 6	1525 8	1293 3	846 3	571 6		227 1	85 4	4558 1
	1994	2 7	3 4	1540 7	1198 0	736 1	290 2		169 2	69 1	4009 2

	Year	Coal	Gas	Gasoline	Diesel Fuel	Mazut	Other oil pr	Hydro	Electricity	Heat	Total
Agriculture	1985	42 1	125 4	178 8	1096 6	35 8			320 4	233 5	2032 6
	1990	13 6	58 [illegible]	99 8	490 2	41 7			344 2	110 1	1160 8
	1991	14 3	78 7	93 9	458 9	46 2			338 3	125 8	1156 0
	1992	12 2	79 8	87 9	439 6	43 2			289 1	140 1	1091 9
	1993	9 5	77 5	80 5	350 2	41 7			299 5	122 0	980 8
	1994	7 5	69 5	73 0	321 8	34 3			279 6	109 8	895 6
Population	1985										
	1990								274 4		274 4
	1991								358 8		358 8
	1992								320 4		320 4
	1993								356 9		356 9
	1994								418 4		418 4
Resid/Comm & Public Services	1985	1129 9	1653 0	113 2	219 0	120 7	6 9			959 8	4202 5
	1990	838 1	2481 8	380 0	58 1	129 6			311 0	1156 0	5354 6
	1991	774 3	2753 1	357 6	53 6	123 7			294 7	1210 2	5567 2
	1992	648 1	3302 6	292 0	50 7	119 5			311 8	1284 1	6008 7
	1993	568 0	2918 4	226 5	37 3	113 2			268 2	1372 8	5504 3
	1994	477 1	2844 3	184 8	31 3	105 8			217 2	1238 4	5098 8
Non specified sectors	1985	44 1	76 4	34 3	156 5	17 9	66 5			148 9	544 5
	1990	38 7	68 4	32 8	83 4	7 5	30 0			410 0	670 7
	1991	30 5	73 0	26 8	44 7	6 0	29 0			280 3	490 3
	1992	26 5	59 3	22 4	41 7	6 0	29 0			201 6	386 4
	1993	14 [illegible]	46 7	16 4	35 8	4 5	28 0			83 5	229 1
	1994	12 9	35 3	10 4	25 3	4 5	27 0			13 3	128 8
NON ENERGY USE	1985	17 6	17 1			205 6					240 4
	1990	6 1	21 7			269 7					297 5
	1991	7 5	22 8			210 1					240 4
	1992	3 4	18 2			169 9					191 5
	1993	2 0	13 7			144 5					160 2
	1994	0 7	11 4			117 7					129 8
	1995										

The structure of final energy consumption by fuels in 1990 was as follows (in brackets there are data for 1994)

* coal	5 9%	(4 2%)
* gas	25 0%	(31 6%)
* petroleum products	37 0%	(33 8%)
* electricity	10 2%	(10 4%)
* district heating	21 7%	(20 0%)

Krasnodar Krai is a net importer of energy, and reliability of energy supply to a large degree depends on reliability of external energy supply

Energy production in Krasnodar Krai in recent years was relatively stable (see Table 13) Electricity production declined in 1990 1994 by 11 percent At the same time mazut production grew by 50%

Specific balances for electricity and heat are presented in Tables 14, 15 and 16

Electricity consumption data present a significant amount of problems with data reliability and consistency

The most substantial discrepances are resulting from the differences in the determination of electricity consumption in agriculture, residential and commercial sectors Agricultural electricity consumption reported in a number of sources often contains energy consumption by rural population for non-productive activities This volume should be shown in the residential sector Residential sector in some sources includes so called other activities Not enough data were available to get all those discrepances fixed As a result, in electricity balance presented in Table 15 residential, commercial and other sectors was combined

Table 13 Energy production in Krasnodarsky krai

	1985	1990	1991	1992	1993	1994
Electricity mln kWth	6707	6920	6917	6605 8	6343 5	6178
Heat, mln Gcal	25 1	28 4	27 3	24 7	23	19 6
Oil and Gas Condensate mln t	3	2	1 9	1 8	1 73	1 604
Mazut, th t	1283	1136	217	200	433	226
Diesel Fuel th t	707	1346	497	453	346	310
Gasoline, th t	1096	616	294	267	194	170
Kerosene, th tce	406	89		179	215	
Natural Gas bln m3	2 9	2 2	1 4	1 4	1 5	1 5

Table 14 Electricity Consumption by Krasnodar Krai (data from various sources)

Energy utilization and information sources	1990	1991	1992	1993	1994
Industry					
VNIIKTEP	5344 5	4421 9	4097 8	3667 4	3427 1
INCOTEK	5345		4097 8	3667 4	
TEB'90	5233				
Kubanenergo'94 (total quarterly)					2925 6
V I Gorin (RAO EES ROSSII)				3763 7	
Agriculture					
VNIIKTEP	4349 8	4568 7	4301 4	4354	3471 5
INCOTEK	2799		3017 7	2871 4	
TEB'90	1526				
Kubanenergo					2273 3
Residential and Commercial					
VNIIKTEP (population included)	3208 6	3494 4	3188 2	3168 3	3472 5
VNIIKTEP (population excluded)	977 6	577 4	583 2	261 3	
INCOTEK	1811		838 6	798 4	
TEB'90 and statistic 11 CH for 1991 1994	1811	752 7	1117 1	469 5	407 3
Kubanenergo				3319 8	1556 6
V I Gorin (RAO EES ROSSII)					
Residential					
VNIIKTEP	2231	2917	2605	2902	
INCOTEK	3654		2604 8	2901 9	
TEB'90 and statistic 11 CH for 1991 1994	3654	3803 3	868 2	4411 6	3496 7
Kubanenergo					3401 4
Other activities					
VNIIKTEP					
INCOTEK	1666		2351 5	2406 8	
TEB'90	1028				
Kubanenergo					2754 8
Construction					
VNIIKTEP	350 9	304 6	151 2	145 4	195 4
INCOTEK	351		151 2	145 4	
TEB'90	205				
Kubanenergo					195 4
Transport					
VNIIKTEP	1986 5	1831 6	1837 4	1846 1	1375 3
INCOTEK	1937		1837 4	1846 1	
TEB'90	1693				
Kubanenergo					1375 3

Table 15 Electricity Consumption by Krasnodarsky Krai*

th kWth

	1990	1991	1992	1993	1994	Structure 1994, %	Rate 1994/1990
Total Consumption	17447 7	16449 6	15270 3	15002 8	13528 8	100	77 54
Own-Use	385 2	383 6	371 3	365 4	286	2 11	74 25
Losses	1872 2	1444 8	1323	1461 2	1301	9 62	69 49
Final Consumption	15190 3	14621 2	13576	13176 2	11941 8	88 27	78 61
Industry	5344 5	4421 9	4097 8	3667 4	2930 3	21 66	54 83
Agriculture	2798 7	2750 2	2350	2435	2273 3	16 80	81 23
Transport	1936 5	1831 6	1837 4	1846 1	1375 3	10 17	71 02
Construction	350 9	304 6	151 2	145 4	195 4	1 44	55 69
Population	2231	2917	2605	2902	3401 4	25 14	152 46
Resid Commerc ,and Others	2528 7	2395 9	2534 6	2180 3	1766 1	13 05	69 84

* CENEf expert estimates based on various sources

Table 16 Heat Consumption in Krasnodarsky Krai

th Gcal

	1985	1990	1991	1992	1993	1994
Generation						
CHP Plants	7353	8500	7930	7410	6200	5125
District Heat ng	17024	18218	18166	16838	15875	13825
Waste Heat Recovery Units	648	1680	1172	1000	845	610
Total	25025	28398	27268	25248	22920	19560
Consumption						
1 Industry	14644	14829	14177	12180	10430	8822
Power sector						
Fuel Industry	1074	1180	1128	960	820	656
Ferrous metalurgy	8	198	186	151	118	103
Non ferrous metalurgy						
Chemical and perochemical	2358	2081	1924	1560	1352	1042
Machinery	1388	1255	1201	982	765	644
Wood Pulp and Paper	1406	1433	1385	1246	965	859
Building materials	1801	1485	1462	12 0	1150	931
Light industry	807	587	498	360	308	251
Food industry	5443	6073	5928	5406	4750	4144
other industry	359	537	465	305	202	192
2 Agriculture	1633	770	880	980	853	768
3 Transport	182	704	712	690	597	483
4 Construction	102	296	271	263	216	184
5 Other	1041	2867	1960	1410	584	93
6 Residential and commercial	6712	8084	8463	8930	9600	8660
Total useful consumption	24314	27550	26463	24503	22280	19010
Losses	711	848	805	745	640	550
Total Consumption	25025	28398	27268	25248	22920	19560

There is no disagreement between the sources on the heat balance for Krasnodar Krai Heat consumption in 1985-1990 grew by 13 5 percent, but then declined by 31 percent in 1990-1994 The major decline occurred in industry - 41 percent It was about as deep as industrial output decline Against this background the volume of heat consumption in the second largest heat consuming sector - residential and commercial - grew by 7 percent

1 5. Energy Prices

Skyrocketing of energy prices is one of the most noticeable changes in the overall energy picture of North Caucasus and Krasnodar Krai Price evolution is presented in Table 17 Data presented in this table indicated prices for the end of the year Time limit did not allow for careful fuels price data collection and aggregation in the region

Average annual data used in calculations were taken from two major sources

- ⇒ Russian energy prices, taxes and costs 1993 IEA/OECD. Paris 1994 100 p
- ⇒ Russian Energy Picture January-March 1995 CENEf Moscow 56 p
- ⇒ For electricity and heat Krasnodar Krai data were taken Several sources were used

Table 17 Wholesale energy prices (rubles)

	1991	1992	1993	1994	March 1995
Natural gas, m^3	44	940	19166	64758	99111
Mazut, t	-	9192	29500	83850	200100
Diesel fuel, t	371	16034	82700	251250	415250
Gasoline, t	117	19710	97974	312250	510400
Electricity, 100 kWh	-		-		-
industrial consumers	5	406	3120	10350	15000
urban population	-	-	500	976	2927
rural population			333	683	2033
Heat for industrial consumers	13	1599	5130	15055	15055

Tables 18 and 18a show nominal and real energy prices corrected for the evolution of GDP price deflator It is clear that real prices were growing with the exception of residential sector Declinel of prices in this sector was one of the major factors neutralizing energy consumption decline Energy prices grew abruptly in the first quarter of 1995

Relative energy prices evolve substantially For example, for residential sector electricity price grew 8,333 fold in 1990 1995, whereas natural gas prices grew by 4,346 times, or just twice as slowly as electricity Steam coal price grew 3,833-fold, and mazut prices - 1,019 fold Energy price competition within the limits of physical infrastructure became a real factor of energy balance evolution for all energy consumption sectors

Table 18 Krasnodar Krai Energy Prices (nominal prices)

Year	Crude oil	Gasoline (a 76)	Diesel Fuel	Mazut	Gas			Coal (Rub/t)		Electricity					Heat (Rub/Gcal)		
	Rub / t				Rub/th m³					(R / RWh)							
					power	industry	resid	steam	coking	industry	trans	agric	commer	urban resid	industry	public	resid
1990	25	195	68	34	23	26	5	12	19	0 018	0 02	0 01	0 01	0.02	2	2	
1991	69	205	143	78	46	52	10	38	70	0 03	0 04	0 025	0 03	0 03	17	4	2
1992	2572	8410	5950	3388	1274	1450	260	959	1825	1 18	1 18	0 77	0 17	0 15	480	117	10
1993	22628	85905	75046	26893	9222	10520	1300	8907	17795	17 15	17 15	8 5	7 78	3 15	4816	2197	48
1994	76800	352000	301000	109000	47600	47600	2000	23600		70	70	16	9	9	12211	26105	2610 5
1995	180000	1120000	880000	367000	113000	113000	20000	46000		150	150	101	150	36	15000	15000	5000

Table 18a Krasnodar Krai Energy Prices (in 1990 prices)

Year	Crude oil	Gasoline (a 76)	Diesel Fuel	Mazut	Gas			Coal (Rub/t)		Electricity					Heat (Rub/Gcal)		
	Rub / t				Rub/th m³					(R / RWh)							
					power	industry	resid	steam	coking	industry	trans	agric	commer	urban resid	industry	public	resid
1990	25 00	195 00	68 00	34 00	23 00	26 00	5 00	12 00	19 00	0 02	0 02	0 01	0 01	0 02	2 00	2 00	1 00
1991	31 94	94 91	66 20	36 11	21 30	24 07	4 63	17 59	32 41	0 01	0 02	0 01	0 01	0 01	7 87	1 85	0 93
1992	69 07	225 83	159 77	90 98	34 21	38 94	6 98	25 75	49 01	0 03	0 03	0 02	0 00	0 00	12 89	3 14	0 27
1993	59 63	226 39	197 77	70 87	24 30	27 72	3 43	23 47	46 90	0 05	0 05	0 02	0 02	0 01	12 69	5 79	0 13
1994	43 99	201 64	172 42	62 44	27 27	27 27	1 15	13 52	0 00	0 04	0 04	0 01	0 01	0 01	6 99	14 95	1 50
1995	71 15	442 69	347 83	145 06	44 66	44 66	7 91	18 18	0 00	0 06	0 06	0 04	0 06	0 01	5 93	5 93	1 98

1 6 Quality of North Caucasus and Krasnodar Krai Statistical Data

Quality of North Caucasus and Krasnodar Krai statistical data which was used to calibrate the model is relatively poor This can be explained by three major factors

- time limit for data collection process determined by the time limit given to CENEf to implement the project,
- poor quality and realibility of energy statistical data in the region, especially for non utility sector,
- lack of culture to openly publish and discuss the energy statistics,
- existence of several different basic methodologies of data clollection and preparation used in different agencies without noting which one was actually used.

The quality of these data was poor before and the situation is worthening now Substantial additional efforts are required to improve the quality of the data This issue has another application related to the presentation of the model results There is no reason to sophisticate the model to the degree when additional accuracy of the results is beyond the accuracy of the statistical evaluation of those indices.

2 General Description of the Energy Balance Model

2 1 Complex of Models

Energy and economic data collection has always been a nightmare in the Former USSR, and even more so now There were and still are many different methodologies and models for energy system evolution projections developed in the Former USSR Many of these methods are not valid any more and should be replaced for at least two reasons

- the system of decision making is under significant evolution and models tuned to command administrative economy with no incorporation of market parameters fail to predict final energy consumers' and energy producers' behavior and reaction to market signals,
- all models were developed to simulate growth of energy system and not enough knowledge is available for the description of energy system in periods of rapid economic decline or revival

For those who are trying to incorporate market variables in their models face another significant challenge lack of more or less reliable information based on which parameters of energy producers' and consumers' reaction to market signals could be calibrated

For modeling energy future of Krasnodar Krai a set of models developed at CENEf was used This set is composed from Regional Energy Balance model (REB) and energy demand models for three subsectors

- industry and construction (RECIN),
- agriculture (RECA),
- residential (RECR)

Shortage of information prevented us from calibration of two other sectoral models for transport and commercial sector

Sectoral models are used to aggregate the impact on sectoral energy demand of such factors as level of economic activity and energy prices Disaggregated information is used to calibrate aggregate model parameters ranges of elasticity coefficients evolution

2 2 General description of the Regional Energy Balance Model

This model describes energy demand by nine energy consuming sectors

- electricity generation,
- CHP,
- boilers,
- own use and losses of energy resources,
- industry and construction,
- agriculture
- transport,
- residential and commercial,
- other, including non-energy use

Six primary energy sources are considered: coal, other solid fuels, petroleum products, natural gas, hydro and nuclear power Six secondary energy carriers are considered for each sector coal, other solid fuels, petroleum products, natural gas electricity, heat

Major exogenous variables of the model are

- population growth,
- rates of GDP growth;
- energy prices by fuels and by sectors,
- volume of hydro power production,
- efficiency of heat and electricity generation,
- elasticity coefficients and interfuel price competition functions

Elasticity coefficients for this model are taken from generalization of multiple sectoral model runs Using a set of various assumptions the range of possible variations of such coefficients was estimated Thereafter such ranges were used in REB model runs

REB model first estimates total energy consumption by sectors using energy demand functions Price impacts influence the results through elasticity coeficients Distributed price effect is mirrored by having this and last year's price growth impacts on the given year energy consumption Then overall consumption is distributed by energy carriers using a matrix of shares Share of every energy carrier depends on the fuel quality (through special coefficients) and relative fuel price As a result of this operation, the matrix of final energy consumption by sectors and by energy sources is calculated

Own use and losses are estimated by multiplying final energy consumption for each energy carrier by a specific coefficient As a result, demand for electricity and district heat is estimated (sum of final use and own use and losses) Then heat generation is distributed by two parts produced by boilers and CHP Lack of information did not allow us to do this operation the way it could have been done

Therefore, energy consumed at CHP was estimated only for the fuel necessary to produce only heat at CHP with all fuels for electricity generation at CHP transferred to the electricity generation sector

Given substantial electricity import to the region, the level of local electricity production is determined by electricity consumption and net import from the regions There is no heat import

After the level of electricity and heat generation is estimated, the structure of fuel balance for the power and heat sectors is determined The first important factor is efficiency of heat and electricity generation It substanially affects the volume of fuel balance for power, CHP and boilers sectors Then, given the matrix of fuels shares determined as a function of relative energy prices, every fuel consumption in power and heat generating sectors is estimated

Primary energy consumption by fuels is a sum of final energy consumption, own use and losses and energy consumption in electricity generating sector, CHP and boilers

Level of local energy production determines the volume of interregional energy trade

2 3 Model Calibration

The model was calibrated based on North Caucasus and Krasnodar Krai data Lack of economic data on North Caucasus (for example, regional energy prices) brought us towards a division to use Krasnodar Krai data as a proxy in some instances As was mentioned before, realibility of these data is questionable Improvement of data inputs will improve calibration of model parameters

3 Projection Scenarios

3 1 General Assumptions

The future of North Caucasus and Krasnodar Krai economic development is very uncertain A number of crucial external factors will substantially effect this future Just a few to mention·

* political stability in North Caucasus region,
* economic policy of the Russian government,
* rates and proportions of economic growth,
* continuation of the trend of Russian population migration to the south,
* availability of fuels in the region and energy prices

Refracted through the prism of problems and specific features of energy supply for the region, the region's energy policy goals are formulated as follows

1 Reliable supply of energy carriers and energy services to consumers,
2 Improving flexibility and adjustability of the energy supply system to energy flow breaks and rapidly changing market conditions,
3 Creation of favorable conditions for energy trade with other regions,
4 Improving the diversity of energy sources used by attracting local resources,
5 Cooperation and coordination of activities of all energy market participants,

6 Stimulating economic growth and improving the competitiveness of goods produced in the region by providing least-cost energy services,
7. Sustainable and environmental friendly development of energy supply systems through rational and efficient energy use,
8. Preserving the balance between energy demand growth and negative impacts caused by energy generation and utilization by coordinated and integrated resource planning

There are a number of approved government decisions which can impact exogenous price variables'

* transition to the full coverage of energy costs by tenants by 1998,
* transition to so-called world energy prices,
* transition of present regional energy commissions to professional ones with making rate cases process transparent

Major exogenous impulses to the REB are

* levels of economic activity by sectors,
* energy prices

Two scenarios for those inputes were developed economic depression and economic revival

3 2 Economic Depression Scenario

Future levels of economic activity are very uncertain Among various projections for the future there is one of the most recent developed by the Central Bank The first scenario was built based on it We named this scenario "economic depression" It suggests that Russian GDP in the year 2000 will still be four percent below the 1994 level (See Table 19) Therefore, it is a very pessimistic scenario Rates of economic activities by sectors were taken from the Central Bank projections As to energy prices, given depressed local energy market, energy lobby will press on the government to bring prices up to the "world level" as soon as possible to keep energy sector alive, and the depth of depression partly will be a result of high energy prices

In this scenario economic depression is combined with high energy prices Such combination leads to the minimum possible energy demand Sensitivity analysis allows to identify variations of electricity or heat demand as a result of variation of major exogenous parameters

Rates of economic growth are proposed equal to -5 percent in 1995, 1 percent per year in 1996 2000 and 4 percent per year thereafter Real energy prices in North Caucasus and Krasnodar Krai in 2000 will approach the real level of "world" energy prices By the "world" level average prices for the USA were used

Therefore, prices in 2000 will be (in April 1995 prices, in brackets growth rate)

- crude oil 270000 rubles/t (240%),
- gasoline - 1197000 rubles/t (235%),
- natural gas for all sectors - 161100 rubles per 1000 m3 (288%),
- electricity for industrial and other sectors - 250 rubles/kWh (2485), and 300 rubles/kWh for residential sector (1480%),

- heat 51000 rubles/Gcal for all sectors (288% for industry and 1350% for residential sector)

Table 19 Russia's Economic Development up to 2000 (annual growth rates a forecast by Central Bank of the Russian Federation)

	1994	1995	1996	1997	1998	1999	2000
Gross Domestic Product	85	94	98	100	101	102	101
Private consumption	85	94	98	100	101	102	101
Fixed capital investment	74	88	101	105	106	106	105
The aggregate industrial output	83	93	98	100	101	102	101
Industry	76	92	97	100	101	102	102
Electric power	89	86	86	90	97	101	101
Fuel	88	94	96	99	100	101	101
Metallurgy	88	93	99	101	102	102	102
Chemical and petrochemical	66	91	97	101	102	102	102
Machinery	61	92	99	102	103	103	103
Timber and paper	67	94	98	101	101	102	101
Building materials	71	92	99	102	103	103	103
Light	51	81	92	101	103	103	103
Food	76	94	98	100	101	101	101
Construction	75	89	101	105	106	106	105
Agriculture and forestry	91	95	98	100	101	101	101
Transport and communication	85	94	98	100	101	102	101
Trade	85	94	98	100	101	101	101

Source Business World Weekly No 13/15

It was proposed that due to autonomous, or non-price induced technical progress - introduction of more efficient equipment and technologies by replacing obsolete ones - energy intensity in each final consuming sector every year will be 1 percent lower

Since market economy is under development, price elastisity will grow from 02, to - 05 in 1995-1999, and then to 1 since the year 2000

3 2 1 North Caucasus

In the economic depression scenario electricity demand will grow by 11 percent in 2010 above the 1994 level, but it will stay below the 1990 level for all 15 years (See Table 20) Electricity demand for the year 2000 is estimated equal to 51,121 mln kWh, and in the year 2010 it will equal 61,778 mln kWh

The structure of electricity demand by sectors will evolve in the favor of industrial sector, but its share will not even approach the 1990 level Contribution of residential and commercial sectors will be about one third against the background of one quarter in 1990

Table 20. Electricity Consumption by Sectors

Parameter		ELECTRICITY							
	Units	Industry 10^6kWh	Agricult 10^6kWh	Transpor 10^6kWh	Resident 10^6kWh	Final 10^6kWh	Own Use 10^6kWh	Total 10^6kWh	Index 93=100
YEARS	1990	25082 11	7982 11	4852 85	14806 50	52723 58	10525 20	63248 78	113 71
	1990	39 66	12 62	7 67	23 41	83.36	16 64	100.00	
	1992	20990 24	9227 64	3791 06	14543 90	48552 85	9917 07	58469 92	105.12
	1993	17950 41	9052 85	3678 05	15247 97	45929 27	9692 68	55621 95	100 00
	1995	13318 29	8003 99	2961 34	15681 92	39965 54	8434 13	48399.66	87 02
	1995	27 52	16 54	6 12	32 40	82 57	17 43	100.00	
	1996	13712 57	7860 99	2893 73	16566 02	41033 32	8659 47	49692.78	89.34
	1997	13908 35	7864 32	2899 49	17032 43	41704.59	8801 13	50505.72	90 80
	1998	14021 32	7884 66	2904 03	17344 05	42154.06	8430.81	50584.88	90 94
	1999	14144 02	7920 18	2908 64	17593 10	42565 94	8513.19	51079 13	91 83
	2000	14561 06	7772 41	2979 57	17646 34	42959 38	8162 28	51121.67	91 91
	2000	28 48	15 20	5 83	34 52	84 03	15 97	100 00	
	2001	15024 66	7991.14	3088 07	17255 67	43359 54	8238.31	51597 86	92 77
	2002	15579 21	8152 14	3199 76	17408 33	44339 45	8424 49	52763 94	94.86
	2003	16154 14	8316 33	3315 50	17632 27	45418 24	8629 47	54047 70	97.17
	2004	16750.18	8482 90	3435 42	17867 12	46535 62	8841 77	55377.39	99 56
	2005	17368 15	8653 65	3559 67	18110 29	47691 76	9061 43	56753 19	102 03
	2005	30 60	15 25	6 27	31 91	84.03	15 97	100 00	
	2010	19498 87	9672 21	3985 40	19197 51	52353 99	9423 72	61777 70	111 07
	2010	31 56	15 66	6 45	31 08	84 75	15 25	100 00	

Table 21. Heat Consumption by Sectors

Parameter		HEAT								Consumption
	Units	Industry 10^3Gcal	Agricult 10^3Gcal	Transpor 10^3Gcal	Resident 10^3Gcal	Non-Speci 10^3Gcal	Final 10^3Gcal	Own Use 10^3Gcal	Total 10^3Gcal	Index 93=100
YEARS	1990	57246 85	4360 14	1850 35	33260 14	5039.86	101757 34	1432 17	103189.51	122 26
	1990	55 48	4 23	1 79	32 23	4.88	98.61	1 39	100.00	
	1992	47383 92	4090 21	1790 21	28409 79	4114.69	85788 81	1274.83	87063 64	103 15
	1993	43958 04	3960 14	1650 35	30492 31	3150.35	83211.19	1190.21	84401 40	100 00
	1995	39352 38	4332 91	1575 11	32065 81	3115 53	80441.74	1150 60	81592 34	96 67
	1995	48 23	5 31	1 93	39 30	3.82	98.59	1 41	100 00	
	1996	38919.46	4106 86	1463 29	30234.02	3009.70	77733.32	1111 86	78845 18	93 42
	1997	38536 19	4041 32	1429 09	29890 43	2965.80	76862.83	1099 41	77962 24	92 37
	1998	38528.61	4037 91	1416 94	30010 53	2965.00	76958 98	1100 78	78059 76	92 49
	1999	38624 24	4046.75	1408 57	30142 12	2969 13	77190.82	1104 10	78294 91	92 76
	2000	39363 89	4008 17	1452 09	30231 29	3014 85	78070.29	1116 68	79186 97	93 82
	2000	49 71	5 06	1 83	38 18	3.81	98 59	1 41	100 00	
	2001	40557 77	4114 94	1504 97	30935 43	3097.92	80211.03	1147 30	81358.33	96 39
	2002	41993 22	4191 70	1559 40	31163 48	3195.81	82103.63	1174 37	83277.99	98 67
	2003	43479 25	4269 87	1615 81	31518 20	3296 77	84179.91	1204 07	85383 98	101 16
	2004	45017 59	4349 03	1674 25	31891 29	3347 99	86280.15	1234 11	87514.25	103 69
	2005	46610 16	4430 08	1734 81	32278 06	3399 97	88453 07	1265 19	89718.26	106 30
	2005	51 95	4 94	1 93	35.98	3.79	98 59	1 41	100.00	
	2010	52022 86	4922 61	1942 28	34016 10	3509 84	96413 69	1379 05	97792 74	115 87
	2010	53 20	5 03	1 99	34 78	3 59	98 59	1.41	100 00	

Demand projection for district heat is shown in Table 21 It will grow by 15 9 percent in 1994-2010, but in 2010 it will still be 5 2 percent below the 1990 level After reduction driven by economic crisis the industrial sector will regain the share in the overall heat consumption It will nearly approach the 1990 level Local heat generation capacities after proper modernization and replacement of obsolete facilities will be sufficient to cover additional heat demand

Sensitivity analysis for this scenario (see Table 22) allows to make the following conclusions.

- fluctuations of economic growth rates by ±1% will bring variation of electricity demand by ±6% in 2010;
- growth of price elasticity coefficient from -0 05 to -0 1 in 1995-2010 is a very substantial parameter for the projection it brings electricity demand down by 3 percent,
- non price promoted technical progress in improving energy efficiency is a very important factor Absence of autonomous technical progress in energy efficiency will bring electricity demand up by 8 5 percent and heat demand up by 8 6 percent,
- if electricity prices are kept at the 1995 level, additional demand for electricity will be about 1 bln kWh in 2010

Table 22 Sensitivity Analysis of Economic Depression Scenario for North Caucasus

		2000	2005	2010
Base assumptions	Electricity D heat	51122 79187	56753 89718	61778 97793
Plus 1% of economic annual growth in 1995-2010	Electricity D heat	52397 81569	59694 95070	65428 104199
Minus 1% of annual economic growth in 1995 2010	Electricity D heat	49893 76897	54034 84781	58424 91921
Coefficient of price elasticity is - 0 1 since 1995	Electricity D heat	49729 77230	55139 87433	59985 95264
No autonomous technical progress in efficiency by final consumption sectors	Electricity D heat	53237 82590	61067 96702	66968 106191
Stable energy prices of the 1995 level	Electricity D heat	51198 87828	57721 99270	62750 107984

3 2 2 Krasnodar Krai

In the economic depression scenario electricity demand will grow by 21 percent in 2010 above the 1994 level, but it will stay below the 1990 level for all 15 years to come Electricity demand for the year 2000 is estimated equal to 13,723 mln kWh, and in the year 2010 it will equal 16,360 mln kWh

The structure of electricity demand by sectors will be more or less stable with a slight growth of the industry share at the expense of residential and commercial sectors (see Table 23)

Table 23 Electricity consumption

Parameter		ELECTRICITY							Consumption
		Industry	Agricult	Transport	Resident	Final	Own Use	Total	Index
	Units	10^3kWh	10^3kWh	10^3kWh	10^3kWh	10^3kWh	10^3kWh	10^3kWh	'94=100
YEARS	1990	5695.37	2798.70	1936 59	4759.67	15190 33	2257 72	17448 05	128 97
	1990	32 64	16.04	11 10	27 28	87.06	12 94	100.00	
	1993	3812.76	2435.04	1846 34	5082 [illegible]8	13176 42	1826.83	15003.25	110 90
	1994	3125 69	2273 33	1375 61	5167 48	11942 11	1586.99	13529.11	100 00
	1995	2670.77	2000 93	1187.77	5272 79	11132 27	1658.71	12790.97	94 54
	1995	20 88	15.64	9.29	41.22	87 03	12 97	100 00	
	1996	2712.56	1926 06	1153 52	5638.29	11430 43	1703.13	13133.56	97.08
	1997	2744.56	1933 72	1156 66	5792 61	11627.55	1732.50	13360.05	98 75
	1998	2764.62	1944 84	1159 49	5893.35	11762 90	1752.67	13515 57	99.90
	1999	2786 29	1959 63	1162 35	5973 73	11882 00	1770 42	13652 41	100 91
	2000	2792 39	1928 02	1160 51	5983 96	11864 87	1767 87	13632 74	100 77
	2000	20 48	14 14	8 51	43 89	87 03	12 97	100"00	
	2001	2890 72	1979 19	1207 58	5866 23	11943 72	1779 61	13723 34	101 44
	2002	3007 31	2025 13	1256 12	5889.50	12178 07	1814 53	13992 60	103 43
	2003	3128 58	2072 12	1306 62	5950.38	12457 69	1856 20	14313.89	105 80
	2004	3254 71	2120 19	1359 14	6014.49	12748 53	1899 53	14648 06	108 27
	2005	3385 91	2169 36	1413 78	6081 55	13050 59	1944 54	14995 13	110 84
	2005	22 58	14 47	9.43	40 56	87.03	12 97	100 00	
	2010	3805 71	2424 22	1588 73	6420 21	14238 87	2121 59	16360 46	120 93
	2010	23 26	14 82	9 71	39 24	87.03	12 97	100.00	

A substantial part of electricity will be imported in the region if the present volume of electricity generation is kept until 2010 About 7 bln kWh in 2000 and 10 bln kWh in 2010 will be required to cover the gap between the demand and present level of electricity generation

Demand projection for district heat is shown in Table 24 It will grow by 21 6 percent in 1995 2010, and in 2010 it will be 17 percent below the 1990 level Higher rates of demand growth in the industrial sector will contribute to the growing share of this sector in the overall heat consumption Local heat generation capacities after proper modernization will be sufficient to cover heat demand

Sensitivity analysis for this scenario (see Table 25) allows to make the following conclusions

- fluctuations of economic growth rates by ±1% brings along variation of electricity demand by ±5% in 2010;
- price elasticity coefficient is a very substantial parameter for the projection,
- non price promoted technical progress in improving energy efficiency is a very important factor Absence of autonomous technical progress in energy efficiency will bring electricity demand up by 7 percent and heat demand up by 8 percent,
- keeping electricity prices at the 1995 level will bring additional demand for electricity by 0 3 bln. kWh in 2010

3.3 Economic Revival Scenario

3 3 1 General Assumptions

The second scenario is based on much more optimistic assumptions Economy will revive Rates of economic growth are proposed equal to -5 percent in 1995, 7 percent per year in 1996-2000 and 5 percent per year thereafter This projection by spirit is closer to the economic program of the Russian government titled "Reforms and Development of Russia's Economy in 1995 1997", where as one option GDP growth rates equal to 3 7 percent are considered for the year 1997

Real energy prices in Krasnodar Krai in 2000 will approach the real level of energy prices in Moscow Region in April 1995 and all subsidies will be removed Therefore, prices in 2000 will be (in April 1995 prices, in brackets growth rate)

- crude oil 270000 rubles/t (240%),
- gasoline 1197000 rubles/t (235%),
- natural gas for all sectors - 161100 rubles per 1000 m^3 (233%),
- electricity for industrial and other sectors - 250 rubles/kWh (2485), and 300 rubles/kWh for residential sector (1480%),
- heat - 51000 rubles/GCal for all sectors (288% for industry and 1350% for residential sector)

Table 24 Heat consumption

Parameter		HEAT							Corsumotion
		Industry	Agricult	Transport	Resident	Final	Own Use	Total	Index
	Units	10^3Gcal	10^3Gcal	10^3Gcal	10^3Gcal	10^3Gcal	10^3Gcal	10^3Gcal	'94=100
YEARS	1990	15127 27	769.93	704 20	8033 92	27552.45	848 25	28400.70	145.19
	1990	53 26	2 71	2.48	28 46	97 01	2 99	100.00	
	1993	10646 15	853.15	597.20	9600 00	22280.42	639 86	22920.28	117.17
	1994	9006 29	767.83	483.22	8660.14	19010 49	550 35	19560.84	100 00
	1995	9300 79	837 74	494.59	9050 57	19683.68	570 83	20254.51	103 55
	1995	45 92	4 14	2.44	44.68	97.18	2 82	100.00	
	1996	9073 75	778 22	456 65	8638 09	18946 71	549 45	19496.17	99 67
	1997	8962 44	768 53	446 31	8533 40	18710 67	542 61	19253.28	98.43
	1998	8953.47	770 30	442 90	8560 95	18727 61	543 10	19270.71	98 52
	1999	8967 53	774 37	440 67	8591 51	18774 08	544 45	19318.53	98.76
	2000	8909.99	770 09	442 77	8618 23	18741 07	543 49	19284 57	98 59
	2000	46 20	3 99	2.30	44 69	97 18	2 82	100 00	
	2001	9210 27	789 37	460 73	8841 21	19301 57	559.75	19861 31	101 54
	2002	9567 72	806.51	479 25	8863 30	19716 77	571 79	20288.56	103.72
	2003	9938 97	824 02	498 51	8941 81	20203.32	585 90	20789 21	106 28
	2004	10324 56	841 90	518 55	9024 94	20709.95	600 59	21310 54	108.94
	2005	10725 03	860 16	539 40	9112 22	21236.81	615 87	21852 67	111 72
	2005	49 08	3.94	2.47	41.70	97.18	2 82	100.00	
	2010	11984 39	955 61	606 15	9563.49	23109.64	670 18	23779 82	121 57
	2010	50 40	4 02	2.55	40.22	97 18	2 82	100 00	

Table 25 Sensitivity Analisys of Economic Depression for Krasnodar Krai

		2000	2005	2010
Base assumptions	Electricity D heat	13632 20254	14955 21853	16360 23779
Plus 1% of economic annual growth in 1995-2010	Electricity D heat	13894 19759	15650 23033	17174 25194
Minus 1% of annual economic growth in 1995-2010	Electricity D. heat	13380 18829	14391 20767	15615 22489
Coefficient of price elasticity is - 0 1 since 1995	Electricity D heat	13288 18799	14590 21271	15907 23133
No autonomous technical progress in efficiency by final comsumption sectors	Electricity D heat	14125 20028	15990 13389	17566 25634
Stable energy prices of the 1995 level	Electricity D heat	13656 21457	15302 24206	16673 26276

This scenario combines high economic growth with relatively low prices and it will determine the upper level of energy demand

3 3 2. North Caucasus

Results of electricity and heat projections for NC are presented in Tables 26 and 27 Electricity consumption in 2010 will reach 70,911 million kWh or 27 percent above the 1993 level and 12 percent above the 1990 level The last milestone will be reached after 2005 The structure of electricity consumption by sectors will evolve, but industrial sector (36% in 2010) will still dominate over the residential and commercial sector (28% in 2010), followed by agriculture (14 3%), and transport (7 3%)

District heat consumption in 2010 will be 35 percent above the 1993 level Heat demand in 2010 will be 10% above the 1990 level. Industrial heat demand is the major driving force for this growth - industrial heat consumption will grow by 53 percent in 1993 2010 In 2004 it will reach the 1990 level Due to such dynamic growth the share of industrial district heat consumption in overall consumption will grow from 50 percent in 1995 to 55 percent in 2000 and to 59 percent in 2010

Sensitivity analysis displays vulnerability of results to the major assumptions made of this scenario Based on these two scenarios uncertainty of the future energy demand for the region will be covered and potential for the future electricity and heat markets by sectors will be estimated

It is important to note that sectoral model runs with high rates of economic growth brought us to the conclusion that higher rates of economic growth are accompanied by lower energy demand to economic activity coefficient Therefore, each percent of GDP growth in economic revival scenario is accompanied by lower electricity and heat demand growth compared to the economic depression scenario

Table 26. Electricity Consumption by Sectors *High*

Parameter		ELECTRICITY							
	Units	Industry 10^6kWh	Agricult 10^6kWh	Transpor 10^6kWh	Resident 10^6kWh	Final 10^6kWh	Own Use 10^6kWh	Total 10^6kWh	Index 93=100
	1990	25082 11	7982 11	4852 85	14806 50	52723.58	10525 20	63248 78	113 71
	1990	39 66	12 62	7 67	23 41	83.36	16 64	100 00	
	1992	20990 24	9227 64	3791 06	14543 90	48552.85	9917 07	58469 92	105 12
YEARS	1993	17950 41	9052 85	3678 05	15247 97	45929.27	9692 68	55621 95	100 00
	1995	13971 74	7922 49	2932 52	15836 10	40662.86	8581 29	49244 14	88 53
	1995	28 37	16 09	5 96	32 16	82.57	17 43	100 00	
	1996	14703 36	7873 25	3037 32	16259 99	41873.92	8836 86	50710 78	91.17
	1997	15729 96	7934.79	3204 57	16470.85	43340.16	9146 29	52486 45	94.36
	1998	16730 16	8007 03	3378 91	16709 06	44825 16	8965 03	53790 19	96.71
	1999	17769 76	8092 79	3564 81	16938 79	46366 15	9273 23	55639 38	100 03
	2000	18354 40	8110 61	3700 05	16839.79	47004 85	8930 92	55935 78	100 56
	2000	32 81	14 50	6 61	30 11	84 03	15 97	100 00	
	2001	19013 97	8293.61	3856 00	17198 10	48361 68	9188 72	57550 40	103.47
	2002	19795 62	8459.97	4030.52	17492 17	49778 28	9457 87	59236 15	106.50
	2003	20609 21	8641 27	4212 93	17803 12	51266 53	9740 64	61007 18	109.68
	2004	21456 22	8825.55	4403 61	18131 81	52817 20	10035 27	62852 46	113.00
	2005	22337 66	9014.47	4602.91	18478 59	54433 63	10342 39	64776 02	116 46
	2005	34 48	13 92	7 11	28 53	84 03	15 97	100 00	
	2010	25181 51	10124 62	5196.51	19591 27	60093 91	10816 90	70910 81	127 49
	2010	35 51	14.28	7.33	27 63	84 75	15 25	100.00	

Table 27. Heat Consumption by Sectors *High*

Parameter		HEAT								Consumption Index
	Units	Industry 10^3Gcal	Agricult 10^3Gcal	Transpor 10^3Gcal	Resident 10^3Gcal	Non-Speci 10^3Gcal	Final 10^3Gcal	Own Use 10^3Gcal	Total 10^3Gcal	93=100
	1990	57246 85	4360 14	1850 35	33260.14	5039 86	101757 34	1432.17	103189.51	122 26
	1990	55 48	4 23	1.79	32 23	4 88	98 61	1.39	100.00	
	1992	47383 92	4090 21	1790.21	28409 79	4114 69	85788 81	1274.83	87063 64	103 15
YEARS	1993	43958 04	3960 14	1650 35	30492 31	3150 35	83211 19	1190 21	84401.40	100 00
	1995	39793 63	4158 12	1503 50	29554 04	3074 60	78083 90	1116.87	79200.77	93 84
	1995	50 24	5 25	1 90	37 32	3 88	98 59	1.41	100 00	
	1996	42257 72	4158 07	1557 23	30257 69	3173 61	81404 31	1164.37	82568.68	97 83
	1997	44310.37	4133 81	1610 65	29519 96	3180 57	82755 37	1183.69	83939.06	99 45
	1998	46368 31	4125 90	1673 33	29211 30	3200 88	84579.71	1209.78	85789 49	101 64
	1999	48673 25	4138 47	1747 92	29126 54	3236.75	86922.92	1243 30	88166 22	104 46
	2000	49832 64	4200 61	1832 89	29494 18	3254 76	88615 09	1267.50	89882.59	106 49
	2000	55 44	4.67	2 04	32.81	3 62	98 59	1.41	100 00	
	2001	51523 24	4287 05	1910 14	30063 30	3305 71	91089 45	1302 90	92392.35	109 47
	2002	53537 24	4364.56	1996 60	30518 03	3368 68	93785 11	1341.45	95126 56	112 71
	2003	55629 45	4449.45	2086.96	31000 28	3432 79	96598 94	1381.70	97980 64	116 09
	2004	57803 40	4535.52	2181.41	31511 37	3498 07	99529 78	1423 62	100953 41	119 61
	2005	60061 25	4623 62	2280 14	32051 73	3564 54	102581 28	1467 27	104048 55	123 28
	2005	57 72	4.44	2 19	30.80	3 43	98 59	1 41	100 00	
	2010	67183 86	5152.84	2574 19	33718.76	3674 61	112304.26	1606 34	113910 61	134 96
	2010	58 98	4 52	2 26	29 60	3 23	98 59	1 41	100 00	

Sensitivity analysis allows to make the following conclusions (see Table 28)

- fluctuations of economic growth rates by ±1% will bring variation of electricity demand by ±6% in 2010,
- growth of price elasticity coefficient from - 05 to -0 1 in 1995 2000 will reduce electricity consumption by 3%,
- non-price promoted technical progress in improving energy efficiency is a very important factor Absence of autonomous technical progress in energy efficiency will bring electricity and heat demand up by 9 percent,
- further 3% annual price growth after 2000 will bring electricity demand down by 0 8 bln kWh,
- keeping electricity prices at the 2000 level against the background of other prices real growth by 3% per year will bring additional demand for electricity by 1 3 bln kWh in 2010

Table 28 Sensitivity Analisys of Economic Revival Scenario for North Caucasus

		2000	2005	2010
Base assumptions	Electricity D heat	55936 89883	64776 104049	70911 113911
Plus 1% of economic annual growth in 1995-2010	Electricity D heat	57236 92206	67994 109656	74923 120661
Minus 1% of annual economic growth in 1995 2010	Electricity D heat	54674 87630	61770 98808	67186 107638
Coefficient of price elasticity is - 0 1 since 1995	Electricity D heat	54117 87865	62992 101661	68919 111255
No autonomous technical progress in efficiency by final consumption sectors	Electricity D heat	58344 93867	69889 112539	77103 124176
Real energy price growth by 3% per year in 2001-2010	Electricity D heat	55936 89883	63964 102725	70087 112526
Real energy price growth by 3% per year for all energy carriers with the exception of electricity	Electricity D heat	55936 89883	65062 103148	71368 112924

3.3 3 Krasnodar Krai

Results of electricity and heat projections for Krasnodar Krai are presented in Tables 29 and 30 Electricity consumption in 2010 will reach 18,109 million kWh or 34 percent of the 1994 level and will be 4 percent above the 1990 level The last level will be reached after 2005 The structure of electricity consumption by sectors will evolve, but residential sector (36% in 2010) will still dominate over the industrial sector (26% in 2010), followed by agriculture (13 3%), and transport (11 4%)

Table 29 Electricity Consumption by Sectors

Parameter		ELECTRICITY							Consumption Index
		Industr_	Agricult	Transpor	Resident	Final	Own Use	Total	
	Units	10^3kWh	10^3kWh	10^3kWh	10^3kWh	10^3kWh	10^3kWh	10^3kWh	'94=100
YEARS	1990	5695 37	2798 70	1936 59	1759.67	15190 33	2257.72	17448 05	128 97
	1990	32 64	16 04	11 10	27.28	87.06	12.94	100 00	
	1993	3812 76	2435 04	1846 34	5082.28	13176 42	1826.83	15003.25	110 90
	1994	3125 69	2273 33	1375 61	5167.48	11942 11	1586 99	13529.11	100 00
	1995	2685 06	2000 93	1201 19	5272 6_	11159 79	1662 81	12822.60	94 78
	1995	20 94	15 60	9 37	41 12	87 03	12.97	100.00	
	1996	2837 35	1923 70	1226 10	5511 11	11498 25	1713 24	13211 49	97 65
	1997	3008 73	1932 90	1292 38	5587.98	11821 99	1761 48	13583.47	100 40
	1998	3189 77	1948 15	1362 42	5656 51	12156 86	1811 37	13968 23	103 25
	1999	3378 85	1966 58	1437 16	5720 70	12503 39	1863 00	14366 39	106.19
	2000	3485 62	1967 70	1491 99	5691.15	12636 46	1882 83	14519 29	107 32
	2000	24 01	13 55	10 28	39 20	87 03	_2 97	100.00	
	2001	3608 66	2005 26	1554.89	5797.78	12966.58	1932 02	14898 60	110 12
	2002	3753 96	2043 78	1625 26	5881.04	13304.04	1982 30	15286.34	112.99
	2003	3905 06	2084 82	1698.82	5969 39	13658.09	2035 06	_5693.15	116.00
	2004	4062 20	2126 65	1775.70	6063 09	14027.64	2090 12	_6117.76	119 13
	2005	4225 60	2169 29	1856 07	6163 24	14414 20	2147 72	16561.92	122 42
	2005	25 51	13 10	11 21	37 21	87 03	12 97	100.00	
	2010	4746 55	2423 27	2095 43	6495 15	15760 40	2348 30	18108.70	133 85
	2010	26 21	13 38	11 57	35 87	87 03	12.97	100.00	

Table 30 Heat Consumption by Sectors

Parameter		HEAT							Consumption
		Industry	Agricult	Transpor	Resident	Final	Own Use	Total	Index
	Units	10^3Gcal	10^3Gcal	10^3Gcal	10^3Gcal	10^3Gcal	10^3Gcal	10^3Gcal	'94=100
YEARS	1990	15127 27	769 93	704 20	8083 92	27552 45	878 25	23400.70	145 19
	1990	53 26	2 71	2.48	28 46	97 01	2 99	100 00	
	1993	10646.15	853 15	597.20	9600 00	22280.42	639 86	22920.28	117 17
	1994	9006 29	767 83	483.22	8660 14	19010 49	550 35	19560.84	100 00
	1995	9350 55	837 74	500.17	9050 26	19738.72	572 42	20311.14	103 84
	1995	46 04	4 12	2.46	44 56	97.18	2 82	100.00	
	1996	9610.86	785 74	492.13	8608 88	19497.60	565 43	20063.03	102 57
	1997	9989.00	778 80	508.52	8407 21	19680.44	570 82	20254.26	103 54
	1998	10419 35	776 38	528.21	8301 28	20025.12	580 73	20605.85	105 34
	1999	10907 81	777 78	551 68	8257 60	20494 87	594 35	21089.22	107 81
	2000	11153 58	788 17	578 61	8367.42	20887 79	605 75	21493.53	109 88
	2000	51.89	3 67	2 69	38 93	97 18	2 82	100.00	
	2001	11524 89	801 66	603 00	8507 66	21437 20	621 68	22058.88	112 77
	2002	11965.67	815 47	630 29	8613 09	22024 53	638 71	22663 24	115 86
	2003	12423 16	830 23	658 82	8725 53	22637 74	656 49	23294.24	119 09
	2004	12897 98	845 25	688 63	8845 30	23277 16	675.04	23952.20	122 45
	2005	13390 78	860 52	719 80	8973 95	23945 06	694.41	24639.46	125 96
	2005	54 35	3 49	2 92	36 42	97 18	2 82	100.00	
	2010	14925 24	953 83	812 63	9384 06	26075 76	756 20	26831 95	137 17
	2010	55 62	3 55	3 03	34.97	97 18	2 82	100 00	

Rates of growth of district heat consumption are about the same - 34 percent in 1994-2010 But heat demand even in 2010 will be lower than in 1990 Industrial heat demand is the major driving force behind this growth - industrial heat consumption grows by 66 percent in 1994 2010 In 2010 it will practically reach the 1990 level Due to such dynamic growth the share of industrial district heat consumption in overall consumption will grow from 46 percent in 1995 to 54 percent in 2000 and to 56 percent in 2010

Sensitivity analysis for Krasnodar Krai allows to make the following conclusions (see Table 31)

- fluctuations of economic growth rates by ±1% will bring variation of electricity demand by +5% in 2010,
- price elasticity coefficient is a very substantial parameter for the projection;
- non-price promoted technical progress in improving energy efficiency is a very important factor Absence of autonomous technical progress in energy efficiency will bring electricity demand up by 7 percent and heat demand up by 8 percent,
- further price growth after 2000 will provide a limited effect on electricity and heat demand,
- keeping electricity prices at the 2000 level against the background of other prices real growth by 3% per year will bring additional demand for electricity for 0 3 bln kWh in 2010

Table 31 Sensitivity Analisys of Economic Revival Scenario

		2000	2005	2010
Base assumptions	Electricity	14519	16562	18109
	D heat	21494	24693	26831
Plus 1% of economic annual growth in 1995 2010	Electricity	14793	17253	18964
	D heat	21988	25842	28257
Minus 1% of annual economic growth in 1995-2010	Electricity	14253	15917	17315
	D heat	21015	23516	25508
Coefficient of price elasticity is 0 1 since 1995	Electricity	13999	15958	17432
	D heat	20933	23977	26093
No autonomous technical progress in efficiency by final consumption sectors	Electricity	15071	17710	19504
	D heat	22257	26472	29046
Real energy price growth by 3% per year in 2001 2010	Electricity	14519	16374	17916
	D heat	21494	24350	26250
Real energy price growth by 3% per year for all energy carriers with the exception of electricity	Electricity	14519	16639	18334
	D heat	21494	24440	26606

Conclusion

Model simulation of future growth of electricity and heat demand in North Caucasus and Krasnodar Krai shows that electricity demand will go up to 49 7-58 3 bln kWh in North Caucasus and to 13 2-15 billion kWh in Krasnodar Krai in the year 2000 and correspondingly to 58.4 - 77 1 billion kWh and 16 - 26 billion kWh in 2010 This range of uncertainty allows room for additional generation of local electric power to substitute imported electricity, replace obsolete facilities and satisfy growing demand

Heat demand will grow up to 76 9 93 9 million Gcal in North Caucasus and 18 8 22 3 million GCal in Krasnodar Krai in the year 2000 and correspondingly 91,9 124 2 million Gcal and 22 5-29 Gcal in the year 2010 It will approach the 1990 level in 2004 in North Caucasus and in 2010 in Krasnodar Krai

Such relatively large range of the projections uncertainty results from the uncertainty with the future economic development as well as from data shortage for the model calibration It seems that this range covers all trajectories of future electricity and heat demand evolution foreseeable in North Caucasus and Krasnodar Krai for the coming 15 years

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