PN-ABS-110

ISN 89529

RESOURCE MANAGEMENT ASSOCIATES
of Madison, Inc.

SUBCONTRACTOR REPORT

LITHUANIAN ENERGY BALANCE

Prepared by
V. Miskinis, Lithuanian Energy Institute
G. Juska, Lithuanian Energy Ministry

Prepared for
RESOURCE MANAGEMENT ASSOCIATES OF MADISON, INC.

DECEMBER 1992

**USAID EMERGENCY ENERGY PROGRAM
FOR EASTERN AND CENTRAL EUROPE**

(USAID Contract #: EUR-0015-C-1006-00)

PN-ABS-110

SUBCONTRACTOR REPORT

LITHUANIAN ENERGY BALANCE

Prepared by
V. Miskinis, Lithuanian Energy Institute
G. Juska, Lithuanian Energy Ministry

DECEMBER 1992

USAID EMERGENCY ENERGY PROGRAM FOR EASTERN AND CENTRAL EUROPE

(USAID Contract #: EUR-0015-C-1006-00)

Prepared for
RESOURCE MANAGEMENT ASSOCIATES OF MADISON, INC.
520 University Avenue, Suite 300, Madison, WI 53703, U.S.A. Telephone: (608) 283-2880 Facsimile (608)283-2881 Telex 469 453

PREFACE

The work in this report is being carried out within the framework of the U.S. Emergency Energy Program for Eastern and Central Europe and the Baltic Republics under a Resource Management Associates of Madison, Inc. (RMA) contract with the U.S. Agency for International Development. RMA, as Prime Contractor to USAID, is currently implementing the Energy Pricing Reform Project and the Industrial Energy Efficiency Project in Romania, Czechoslovakia and Lithuania. The report is one of a series describing the activities, results and recommendations of the projects.

The report, entitled "Lithuanian Energy Balance" is one of a series of four papers written by Lithuanian subcontractors. The study was done by Lithuanian energy analysts with limited guidance from the RMA. The authors are V. Miskinis and A. Juska of the Lithuanian Energy Institute and the Lithuanian Energy Ministry respectively.

The report provides a restatement of Lithuanian energy supply and use, using international conventions. The report is an useful overview of the Lithuanian energy balance.

This is a working document published informally by RMA. To present the results of the project with the least possible delay this report has not been prepared in accordance with procedures appropriate to our formally printed documents. The report was not edited and received only very light review by RMA. Comments were made on the first draft of the paper. **An errata table is provided; comments clarify tables with insufficient captions and correct glaring errors.** RMA does not necessarily endorse the views expressed or the findings presented in the text. The document's subject matter warrants its distribution.

ABSTRACT
LITHUANIAN ENERGY BALANCES

by V. Miskinis, and G. Juska
December, 1992

The national energy balance for Lithuania was reviewed and adjusted using international conventions to better understand and forecast consumption trends. The energy balance as calculated prior to 1990 differs from a conventional energy balance in several ways: 1) the USSR Central Statistics Board added some shares of common Soviet energy consumption to Lithuanian consumption; 2) only some energy sources were included and; 3) accounting of heat consumption was unsatisfactory. Adjustments in the balances result in apparent changes including: 1) Lithuania consumed more primary energy for electricity production because transmission losses were included in exported power and; 2) primary energy consumption at hydroelectric and nuclear power plants appears higher. This increase is due to accounting changes. Prior to 1990 power production at nuclear and hydroelectric power plants was converted to TOE of primary energy using conversion coefficients from fossil fueled thermal power plants (e.g. 261 grams oil/kWh for nuclear plants and 86 grams oil/kWh for hydroelectric facilities), not using the actual thermal efficiency of each plant, as is the United Nations convention.

The authors present a series of tables and figures with primary and enduse energy consumption in metric ton oil and coal equivalent for the period 1960-1992 determined using international conventions. Primary and enduse energy consumption is shown for each sector of the economy, including power export, and by energy type (electricity, heat and fuel). A table in the text compares the 1990 primary energy consumption determined using pre-1990 accounting methods and using international conventions.

ERRATA

General:

1. The majority of the tables are not specifically referred to in the text. However, the relevant tables can be identified with modest effort.

Page Specific:

Page	Comment
4	The last few sentences of text discuss the three rows of data: showing total primary energy consumption, primary energy needs of Lithuania and the real energy demand which includes energy for export. These comments refer to the rows at the bottom of the tables beginning on page 8.
5	Table 1. Presents energy production and consumption data determined using two methods. In column I, a conversion factor derived from thermal plants was used to convert energy production from nuclear and hydroelectric plants to primary resource needs. This had been the method used by Lithuania in former times. In column II, the United Nations method is used to convert nuclear and hydroelectric power production to primary consumption. The UN method uses the actual conversion efficiency of the nuclear and hydroelectric facilities. All proceeding tables use the UN method.
6	Table 2 shows primary energy consumption for 1985-1992 in t.c.e. (metric ton coal equivalent).
7	Table 3 shows primary energy consumption, for 1960-1990 in t.o.e. (metric ton oil equivalent), with a little more detail than Table 2.
8	Table 4 is the same as Table 3 but the units are t.c.e.
9-12	Table 5 is again a table of primary energy consumption, but this time by sector and energy type (electricity, heat and other fuels) in five year intervals from 1960-1990 in t.o.e. The "consumption of industry", in the third to last row, is greater than the consumption of industry in row 1 because agriculture in included in the former.
13-16	Table 6 is the same as Table 5 but in t.c.e.
14-20	Table 7 shows the consumption of electricity, heat and fuel at end use in t.o.e. The table is laid out similar to Tables 5 and 6. Values in the electricity, heat and fuel columns are the same as in Table 5. Only the values in the "Fin. energy" or enduse energy column are different. They are lower than in Table 5, because conversion losses are excluded.
21	On Figure 1. the fill pattern, at the bottom center of the key, should be labeled nuclear not "natural gas". The label "Oil & his pr." should be labeled Oil and oil products.

Energy Price Reform Working Group
Government of Lithuania

LITHUANIAN ENERGY BALANCE

Prepared by
V. Miskinis LEI
A. Juska, LEM

Under contract with Resource Management Associates, Madison, Wisconsin, U.S.A.

BEST AVAILABLE COPY

/

The real balance of energy resources differs from data published in various statistical issues or presented by various authors. There are some reasons of that:

1. Methodology of preparation statistical energy balances was different in the period 1960 - 1990.

2. The Central Statistic Board of the USSR prepared the final variant of balances and added the some share of common Soviet energy consumption to Lithuanian energy consumption.

3. In official balances only a centralised supply of energy resources was evaluated.

4. Account of fuel and especially of heat consumption was unsatisfactory.

5. Energy resources planning and analysis were provided in different departments etc.

The State Planning Committee of Lithuania was preparing the detailed annual energy balances only for branches of economy supervised by the Lithuanian government. The major part of economy was ruled directly from Moscow, and its energy demand was planned at the central department of the USSR. So the common energy balance of energy resources was prepared once a five years.

In order to prepare dynamics of primary energy demand for a long period and to investigate the trends in different branches of national economy we have to analyse energy balances of corresponding years thoroughly using the common methodology.

With integrating into the West European energy systems Lithuania must to re-evaluate its energy and fuel consumption. Western principles of calculation the energy balance must be elaborated. It's necessary in order to compare energy consumption level and to forecast energy demand.

At present one needs to separate 2 principles of energy balance construction: 1) how much of fuel and energy consumes Lithuania, 2) what was the real energy demand if Lithuania was developed as an independent state, not as a part of Soviet empire. Both aspects earlier were mixed asa final aim was the unified USSR energy buget. Lithuania as an independent state in a new economical and political situation needs to have its own energy buget.

BEST AVAILABLE COPY

Earlier only that part of energy resources which was needed for a local consumption was included into the energy balance. All the final energy demand was evaluated. But serious part of losses caused by energy transmission abroad was added to the exported production. Therefore, in Lithuania were consumed more of primary energy than it was claimed in the official statistics. Only electric energy production, consumption, import and export were finally evaluated.

When preparing the energy balance permanent discussions were going on the hydro and nuclear energy evaluation. In a Soviet statistics energy produced at hydro or nuclear power plants was transfered into primary energy according to comparative consumption of fossil fuel at a corresponding thermal power plant. In Lithuania it was compared with an average of fuel consumption in all the thermal power plants. At the same time in western statistics nuclear energy was calculated according to real productivity of the plant. The productivity coefficient was roughly 33% for the Ignalina NPS. So in order to produce 1 kWh at the Ignalina NPS one needs 261 g of oil equivalent nuclear fuel. At the same time hydroenergy as also import and export are calculated according to physical equivalent, i.e. 86 g o.e. for 1 kWh.

A new evaluation of nuclear and hydro energy changes the total amount of energy consumed as also shares of different energy sources in the final energy balance. It explains the data given in table 1. There hydro and nuclear energy are calculated according to an average consumption of fossil fuel in thermal power plants (variant 1) and according to the metholodogy of the United Nations (variant 2). In general calculations in the first variant are more convenient as they characterize the amount of energy resources needed to import if there were no hydro and no nuclear. But in a real energy budget one needs to use the Western metholodogy.

It's obvious, the new energy balance differs from the old one. So we need to separate two different energy types. 1) the final energy (electricity, heat and direct fuel consumption) is needed to cover demand in material production and services sectors, 2) the primary energy is used not only to cover consetic

BEST AVAILABLE COPY

demand but also for an export.

There is a characteristic example of the Lithuanian power system. An export possibility weas significantly increased with commissioning the Ignalina NPS. For example, in 1991 there were generated 27 TWh of electricity in Lithuania (own consumption at the power plants not included) and only 14.3 TWh consumed (including network losses) - it gives only 52.9% of the total. So we could see that all the primary resources consumed for power production could be divided into 3 parts: domestic demand, export and export losses. It is given in the following tables and figures.

There is one an important feature - Lithuania imports fuel, but exports electricity. Therefore, unlike the other data set in the table presented here there are three rows of total energy consumption and there are also three rows of primary energy resources for electricity generation:

1. The total primary energy consumption (for production of electricity and heat, direct use, consumption as raw materials, losses and other directions).

2. The second row shows how much of energy resources would be needed if production of electricity would be equal to the consumption of electricity in Lithuania.

3. The real energy demand of Lithuania, which evaluates not only our own needs but also losses of fuel due to electricity generated for the export.

BEST AVAILABLE COPY

Table 1

Production of electricity and consumption of fuel in 1990

		I	II
1. Production of electricity, bln.kWh		28.40	28.40
Elektrenai termopower station		7.81	7.81
Combined heating plants		3.14	3.14
Hydropower stations		0.42	0.42
Ignalina nuclear power station		17.03	17.03
2. Consumption in Lithuania		16.43	16.43
Export		11.97	11.97
3. Consumption of primary energy resources			
	mln.t c.e.	8.18	9.06
	mln.t o.e.	5.72	6.33
Fossil fuel	mln.t c.e.	3.15	3.15
	mln.t o.e.	2.20	2.20
Other resources	mln.t c.e.	5.03	5.91
	mln.t o.e.	3.52	4.13
Relative consumption	g c.e./kWh	288	319
	g o.e./kWh	201	223

BEST AVAILABLE COPY

Table 3

Energy consumption in Lithuania

Mln. t c.e.

Energy demand	1985	1989	1990	1991	1992
1. Fossil fuel	19.82	20.58	18.72	19.76	12.37
Natural gas	5.18	5.93	6.88	8.92	4.50
Heavy fuel oil	7.15	6.48	4.85	3.23	2.90
Oil & other his products	5.88	6.42	5.73	5.97	3.20
Coal	1.22	1.29	1.17	1.05	0.95
Domestic fuel	0.63	0.48	0.49	0.54	0.62
2. Nuclear	3.26	5.73	5.85	5.82	5.05
3. Hydro & secondary heat	0.26	0.32	0.31	0.31	0.26
4. Total primary resources	23.34	26.63	24.88	25.88	17.48
Needs of Lithuania	22.57	25.14	23.41	24.31	16.69
incl. losses of export	1.55	3.03	2.99	3.19	1.20
Export of electricity	0.77	1.49	1.47	1.57	0.59
Direction of consumption					
5. Production of electricity	8.61	9.30	9.01	9.35	6.10
6. Production of heat	5.84	5.78	5.71	5.98	4.20
7. Direct consumption of fuel	8.11	9.11	7.78	8.45	5.90
8. Raw mater., losses & other	2.78	2.44	2.38	2.10	1.28

BEST AVAILABLE COPY

Table 3 Primary energy consumption in Lithuania

mln. t o.e.

	1960	1965	1970	1975	1980	1985	1990
1.Total consumption	3.83	5.62	7.95	9.95	12.24	16.33	17.43
needs of Lithuania	3.84	5.35	7.42	9.83	12.22	14.91	14.71
n.of Lith.with exp.	3.83	5.54	7.76	9.91	12.23	15.79	16.40
2.Sort of resources							
Fossil fuel	3.77	5.57	7.89	9.86	12.11	13.86	13.09
natural gas		.92	1.11	1.53	2.55	3.61	4.67
heavy fuel oil	.12	.83	2.65	4.15	5.90	5.00	3.25
coal	.96	1.13	1.23	1.11	.96	.81	.73
light fuel oil				.16	.30	.35	.42
domestic fuel oil	1.84	1.50	1.18	.67	.47	.44	.34
motor fuel	.73	1.08	1.55	1.99	2.55	2.75	2.65
other	.12	.11	.17	.24	.30	.90	1.00
Other resources	.06	.05	.06	.10	.13	2.47	4.34
nuclear energy						2.28	4.12
hydro energy	.03	.03	.04	.03	.04	.03	.04
secondary heat	.03	.02	.03	.06	.09	.15	.18
3.Direction of consumption							
Production of electr	.37	.90	1.63	1.90	2.47	4.63	6.33
needs of Lithuania	.38	.64	1.10	1.78	2.44	3.21	3.61
n.of Lith.with exp.	.37	.82	1.45	1.85	2.46	4.09	5.30
Production of heat	.35	.94	1.60	2.55	3.45	4.09	3.99
incl.fossil fuel	.32	.92	1.57	2.49	3.36	3.93	3.78
Direct use	3.06	3.54	4.31	4.83	5.30	5.68	5.44
incl.motor fuel	.71	.99	1.48	1.88	2.35	2.32	2.11
Raw mat.losses, oth.	.05	.23	.41	.68	1.02	1.94	1.66
incl.other direct.	.00	.07	.08	.17	.10	.51	.75
Export of direct.	.00	.03	.18	.05	.01	.54	1.03
4.Import of fossil fue	1.93	4.07	6.71	9.19	11.64	13.42	12.75
incl.oil & his pr.	.97	2.02	4.38	6.52	8.09	8.96	7.25

BEST AVAILABLE COPY

Table 4.Primary energy consumption in Lithuania

mln. t c.e.

	1960	1965	1970	1975	1980	1985	1990
1.Total consumption	5.48	8.04	11.37	14.23	17.50	23.35	24.93
needs of Lithuania	5.49	7.67	10.60	14.06	17.47	21.33	21.04
n.of Lith.with exp.	5.48	7.92	11.10	14.17	17.49	22.58	23.46
2.Sort of resources							
Fossil fuel	5.40	7.96	11.28	14.10	17.32	19.82	18.72
natural gas		1.31	1.58	2.19	3.64	5.16	6.58
heavy fuel oil	.17	1.19	3.79	5.93	7.14	7.15	4.85
coal	1.38	1.62	1.76	1.59	1.37	1.16	1.04
light fuel oil				.23	.43	.49	.60
domestic fuel oil	2.63	2.14	1.68	.95	.67	.63	.49
motor fuel	1.04	1.54	2.22	2.85	3.64	3.94	3.79
other	.18	.16	.25	.35	.43	1.29	1.43
Other resources	.08	.08	.09	.14	.18	3.53	6.21
nuclear energy						3.26	5.89
hydro energy	.05	.04	.05	.05	.06	.05	.05
secondary heat	.04	.03	.04	.09	.13	.22	.26
3.Direction of consumption							
Production of electr	.53	1.29	2.34	2.71	3.53	6.61	9.06
needs of Lithuania	.54	.92	1.57	2.54	3.49	4.59	5.17
n.of Lith.with exp.	.53	1.17	2.07	2.65	3.52	5.85	7.58
Production of heat	.50	1.35	2.29	3.65	4.93	5.84	5.71
incl.fossil fuel	.46	1.32	2.25	3.56	4.80	5.63	5.41
Direct use	4.37	5.06	6.17	6.90	7.58	8.12	7.78
incl.motor fuel	1.02	1.42	2.12	2.69	3.36	3.31	3.02
Raw mat.losses, oth.	.08	.33	.58	.97	1.46	2.72	2.38
incl.other direct.	.00	.10	.11	.24	.14	.13	1.07
Export of direct.	.00	.12	.27	.06	.01	.76	1.48
4.Import of fossil fue	2.77	5.82	9.60	13.14	16.65	19.19	18.23
incl.oil & his pr.	1.39	2.89	6.26	9.32	11.57	12.81	10.38

ST AVAILABLE COPY

TABLE 5

Consumption of primary energy resources

	1960				1985			
	Electricity min. kWh	Heat th.Gcal	Fuel th.t o.e.	Total th.t o.e.	Electricity min. kWh	Heat th.Gcal	Fuel th.t o.e.	Total th.t o.e.
1.Industry	562.80	1,264.00	556.57	961.81	1,401.70	4,347.20	528.67	1,456.23
its branches:								
a) fuel ind.		7.00	34.27	35.48	17.30	34.00	26.37	35.51
b) ind. chemicals	4.40	137.50	4.55	29.77	213.00	521.00	8.74	120.47
c) machinery	122.00	128.40	32.17	94.86	313.30	420.30	76.79	168.14
d) paper & its pr.	108.00	196.00	3.50	77.22	204.70	620.00	[illegible]	175.59
e) building mater.	102.00	127.80	293.71	349.63	217.90	730.30	721.63	481.22
f) light industry	37.10	186.00	1.47	62.52	162.10	880.00	.77	129.71
g) food industry	117.90	426.00	141.82	254.57	135.60	1,180.00	112.59	216.52
h) rest of industry	21.40	55.30	45.06	61.74	137.80	132.20	19.27	59.52
2.Construction	26.60	12.30	93.85	104.81	46.10	114.50	104.80	131.49
3.Transport	25.10	8.70	873.99	883.83	46.20	91.50	1,111.40	1,124.34
4.Agriculture	60.60	28.10	187.76	212.73	184.30	30.00	332.17	379.35
5.Residential	284.00	677.90	1,347.06	1,558.47	571.70	1,969.70	1,462.38	1,867.30
End use	959.10	1,991.00	3,059.23	3,721.65	2,250.00	6,552.90	3,539.52	4,969.96
Auxiliaries	62.50			20.75	255.30			59.91
Raw material			30.77	30.77			107.83	107.83
Losses	108.30	82.40	23.50	73.69	382.60	44.20	57.83	153.69
Other						281.50	67.43	106.25
Total consumption	1,129.90	2,073.40	3,113.50	3,846.86	3,887.90	6,879.60	3,772.16	5,397.64
Production	1,122.00				3,851.10			
Total consumption of resources				3,845.89				5,523.64
Demands of Lithuania				3,846.86				5,397.63
Consumption with export of electr.				3,845.39				5,540.79
Total consumption of industrie				1,013.30				1,524.12
Relative consumption of fuel for prod.			331.99				234.65	
			172.73				137.72	

BEST AVAILABLE COPY

	1970				1975			
	Electricity mln.kWh	Heat th.Gcal	Fuel th.t o.e.	Total th.t o.e.	Electricity mln.kWh	Heat th.Gcal	Fuel th.t o.e.	Total th.t o.e.
1.Industry	2,461.80	7,860.00	847.41	2,367.31	4,138.10	11,724.10	1,132.37	3,378.71
its branch:								
a)fuel	28.30	87.90	12.52	29.69	22.10	53.80	10.91	21.37
b)chemic.	612.10	1,423.00	24.69	336.78	1,181.70	2,742.10	22.66	593.06
c)machin.	387.40	1,145.00	59.44	331.61	877.30	1,426.10	86.29	438.78
d)paper &	276.20	1,007.00	16.78	202.81	451.10	1,416.00	26.96	237.96
e)build.	375.60	1,383.00	320.78	775.84	694.70	2,192.90	740.84	1,144.17
f)light	297.00	1,126.00	3.99	209.37	428.40	1,485.00	5.70	269.99
g)food	183.80	1,302.60	157.34	384.26	261.90	2,176.40	187.48	497.36
h)rest	101.40	185.50	51.67	97.15	220.90	231.80	51.97	125.72
2.Constr.	75.30	368.10	178.18	240.49	101.60	512.30	146.71	228.17
3.Transp.	107.00	150.00	1,309.72	1,352.04	170.30	180.00	1,501.12	1,558.13
4.Agricult	422.20	95.90	397.48	503.03	933.60	230.60	450.84	674.84
5.Resid.	1,052.30	3,796.50	1,578.67	2,282.45	1,717.80	8,309.10	1,593.78	2,929.08
End use	4,118.60	12,270.50	4,311.46	6,745.32	7,061.40	20,956.10	4,825.32	8,768.89
Auxiliar.	428.20			95.00	507.20			107.02
Raw mater.			287.97	287.97			463.15	463.15
Losses	639.60	398.60	37.41	228.70	907.60	626.40	44.41	309.26
Other		250.00	80.00	110.97		220.00	168.95	194.71
Total con	5,186.40	12,919.10	4,716.84	7,467.96	8,476.20	21,802.50	5,501.83	9,843.13
Produc.	7,362.90	12,919.10			8,993.20	21,802.50		
Con of res				7,950.86				9,952.12
Needs				7,467.96				9,843.03
Ex of el.				7,763.65				9,707.65
Con of ind.				2,750.22				3,948.88
Fuel for ar.			221.87				211.01	
			123.88				117.09	

BEST AVAILABLE COPY

Energy consumption in Lithuania

	1980				1985			
	Electricity min.kWh	Heat th.Gcal	Fuel th.t o.e.	Total th.t o.e.	Electricity min.kWh	Heat th.Gcal	Fuel th.t o.e.	Total th.t o.e.
1.Industry	4,844.40	14,064.80	1,352.80	4,018.43	5,766.30	17,001.00	1,706.29	4,984.85
its branch:								
a)fuel	50.00	345.60	64.97	115.87	250.00	1,378.00	194.41	412.19
b)chemic.	1,280.00	2,896.40	57.20	665.88	1,456.20	3,555.00	178.32	919.14
c)machin.	1,030.00	1,884.10	96.64	534.34	1,170.60	2,273.00	76.22	602.74
d)paper &	460.00	1,899.30	35.38	334.27	531.60	2,073.00	[illegible]	[illegible]
e)build.	810.00	2,529.30	859.09	1,325.51	850.40	2,621.00	1,050.35	1,547.29
f)light	520.00	1,735.40	4.69	317.15	599.00	1,701.00		332.90
g)food	330.00	2,374.50	222.17	568.99	441.60	3,007.00	125.87	578.16
h)rest	364.40	400.20	12.66	136.42	466.90	393.00	50.35	199.73
2.Constr.	210.00	581.50	154.76	267.02	258.20	468.00	153.85	266.05
3.Transp.	230.00	242.60	1,613.22	1,690.18	254.00	327.00	1,853.15	1,947.78
4.Agricult	1,790.00	1,567.20	480.49	1,041.99	2,298.60	1,433.00	445.45	1,121.72
5.Resid.	2,415.60	12,040.00	1,716.08	3,631.69	3,142.50	14,309.00	1,516.78	3,895.75
End use	9,490.00	28,496.10	5,317.35	10,649.31	11,719.60	33,538.00	5,675.52	12,219.13
Auxiliar.	655.60			138.69	1,437.50			317.17
Row mater.			863.01	863.01			1,352.45	1,352.45
Losses	1,370.00	927.10	64.83	462.81	1,584.50	1,178.00	81.82	570.44
Other	44.40	130.00	78.53	103.09		7.00	508.39	509.22
Total con	11,560.00	29,553.20	6,323.72	12,216.91	14,741.60	34,723.00	7,618.18	14,968.43
Produc.	11,665.50	29,553.20			20,962.40	34,723.00		
Con of res				12,239.23				16,340.99
Needs				12,216.91				14,968.43
Ex of el.				12,230.16				15,805.91
Con of ind.				5,020.13				6,654.47
Fuel for pr.			211.55				220.64	
			116.66				118.01	

BEST AVAILABLE COPY

	1990			
	Electricity min.kWh	Heat th.Gcal	Fuel th.t o.e.	Total th.t o.e.
1.Industry	5,923.90	16,457.00	1,504.20	4,755.29
its branch:				
a)fuel	456.60	1,728.00	526.57	931.06
b)chemic.	1,186.70	3,223.00	72.73	715.35
c)machin.	1,246.70	2,295.00	67.13	614.29
d)paper &	560.60	2,120.00	39.86	413.51
e)build.	901.60	2,411.00	683.31	1,169.13
f)light	613.90	1,196.00	6.99	294.15
g)food	483.60	2,987.00	51.75	509.92
h)rest	474.20	497.00	53.86	217.88
2.Constr.	257.50	648.00	106.29	239.71
3.Transp.	247.10	212.00	1,687.41	1,767.37
4.Agricult	2,696.90	1,911.00	446.85	1,272.32
5.Resid.	3,644.40	13,496.00	1,698.60	4,094.14
End use	12,769.80	32,724.00	5,443.35	12,128.83
Auxiliar.	2,108.20			470.07
Row mater.			679.72	679.72
Losses	1,552.00	1,444.00	235.66	751.08
Other		6.00	748.95	749.65
Total con	16,430.00	34,174.00	7,107.68	14,779.35
Produc.	28,403.00	34,174.00		
Con of res				17,448.97
Needs				14,779.35
Ex of el.				16,419.12
Con of ind.				5,905.08
Fuel for pr.			222.97	
			117.29	

BEST AVAILABLE COPY

TABLE 6

Energy consumption in Lithuania

	1960 Electricity mln. kWh	1960 Heat th.Gcal	1960 Fuel th.t c.e.	1960 Total th.t c.e.	1965 Electricity mln. kWh	1965 Heat th.Gcal	1965 Fuel th.t c.e.	1965 Total th.t c.e.
1.Industry	562.30	1,264.00	795.90	1,375.38	1,401.70	4,347.20	756.00	2,182.48
its branches:								
a) fuel ind.		7.00	49.00	50.73	17.30	34.00	38.00	50.50
b) inc. chemicals	4.40	137.50	6.50	42.56	213.00	521.00	12.50	186.38
c) machinery	122.00	128.40	46.00	135.64	313.30	420.00	32.60	240.44
d) paper & its pr.	103.00	196.00	5.00	104.70	204.70	620.00	[illegible]	197.39
e) building mater.	102.00	127.30	420.00	500.30	217.70	730.00	460.00	666.77
f) light industry	87.10	186.00	2.10	39.40	162.10	660.00	[illegible]	135.47
g) food industry	117.90	426.00	202.80	364.02	135.60	1,130.00	161.00	473.39
h) rest of industry	21.40	55.30	64.50	68.32	137.80	132.20	27.70	99.93
2.Construction	26.60	12.30	134.20	149.87	46.10	114.50	150.00	185.02
3.Transport	25.10	8.70	1,249.80	1,263.87	46.20	91.50	1,589.30	1,622.82
4.Agriculture	60.60	28.10	268.50	304.21	134.30	30.00	475.00	542.75
5.Residential	284.00	677.90	1,926.30	2,228.61	571.70	1,969.70	2,091.20	2,670.95
End use	959.10	1,991.00	4,374.70	5,321.94	2,250.00	6,552.90	5,061.50	7,107.02
Auxiliaries	62.50			29.67	255.30			85.67
Row material			44.00	44.00			154.20	154.20
Losses	108.30	82.40	33.60	105.37	382.60	44.20	82.70	219.79
Other						231.50	96.50	151.94
Total consumption	1,129.90	2,073.40	4,452.30	5,500.98	2,887.90	6,878.60	5,394.90	7,718.61
Production	1,122.00				3,331.10			
Total consumption of resources				5,500.01				8,341.81
Demands of Lithuania				5,500.98				7,718.61
Consumption with export of electr.				5,500.01				7,923.34
Total consumption of industrie				1,449.35				2,322.35
Relative consumption of fuel for prod.			474.74				335.55	
			247.07				196.94	

BEST AVAILABLE COPY

	1970				1975			
	Electricity min.kWh	Heat th.Gcal	Fuel th.t c.e.	Total th.t c.e.	Electricity mln.kWh	Heat th.Gcal	Fuel th.t c.e.	Total th.t c.e.
1.Industry	2,461.80	7,860.00	1,211.80	3,385.28	4,138.10	11,724.10	1,620.00	4,231.60
its branch:								
a)fuel	28.30	87.90	17.90	42.45	22.10	53.80	15.60	31.28
b)chemic.	612.10	1,423.00	35.30	481.59	1,181.70	2,742.10	32.40	848.09
c)machin.	587.40	1,145.00	85.00	474.21	877.30	1,426.10	123.40	626.89
d)paper &	276.20	1,007.00	24.00	290.02	451.10	1,416.00	78.80	411.50
e)build.	375.60	1,383.00	745.00	1,109.17	694.70	2,192.90	1,159.40	1,675.13
f)light	297.00	1,126.00	5.70	299.40	429.40	1,485.00	5.20	736.11
g)food	183.80	1,502.60	225.00	549.50	261.90	2,176.40	268.10	711.52
h)rest	101.40	185.50	73.90	138.94	220.90	231.80	74.30	179.75
2.Constr.	75.30	368.10	254.80	343.90	101.60	512.30	209.80	326.23
3.Transp.	107.00	150.00	1,872.90	1,933.42	170.30	180.00	2,146.60	2,228.12
4.Agricult	422.20	95.90	568.40	719.34	933.60	330.60	644.70	965.01
5.Resid.	1,052.30	3,796.50	2,257.50	3,263.92	1,717.30	8,309.10	2,279.10	4,186.42
End use	4,118.60	12,270.50	6,165.40	9,645.86	7,061.40	20,956.10	6,900.20	12,539.58
Auxiliar.	428.20			135.86	507.20			153.04
Raw mater.			411.80	411.80			662.30	662.30
Losses	639.60	398.60	53.50	327.04	907.60	626.40	63.50	442.24
Other		250.00	114.40	158.69		220.00	241.60	278.43
Total con	5,186.40	12,919.10	6,745.10	10,679.25	8,476.20	21,802.50	7,867.60	14,075.59
Produc.	7,362.90	12,919.10			8,993.20	21,802.50		
Con of res				11,369.82				14,231.60
Needs				10,679.26				14,075.60
Ex of el.				11,102.11				14,168.01
Con of ind.				3,932.94				5,646.94
Fuel for pr.			317.28				301.74	
			177.15				167.43	

BEST AVAILABLE COPY

Energy consumption in Lithuania

	1980				1985			
	Electricity mln.kWh	Heat th.Gcal	Fuel th.t c.e.	Total th.t c.e.	Electricity mln.kWh	Heat th.Gcal	Fuel th.t c.e.	Total th.t c.e.
1.Industry	4,844.40	14,064.80	1,934.50	5,746.27	5,766.30	17,001.00	2,440.00	7,128.41
its branch:								
a)fuel	50.00	345.60	92.90	165.68	250.00	1,378.00	278.00	589.43
b)chemic.	1,280.00	2,896.40	81.80	952.19	1,456.20	3,555.00	255.00	1,314.39
c)machin.	1,030.00	1,884.10	138.20	764.09	1,170.60	2,273.00	109.00	861.93
d)paper i	460.00	1,899.30	50.60	506.60	531.60	2,073.00	44.00	561.56
e)build.	810.00	2,529.30	1,228.50	1,895.47	850.40	2,621.00	1,502.00	2,212.63
f)light	520.00	1,735.40	6.70	453.50	599.00	1,701.00		476.15
g)food	330.00	2,374.50	317.70	813.64	441.60	3,007.00	180.00	826.79
h)rest	364.40	400.20	18.10	195.10	466.90	393.00	72.00	285.63
2.Constr.	210.00	581.50	221.30	381.83	258.20	468.00	220.00	380.44
3.Transp.	230.00	242.60	2,306.90	2,416.95	254.00	327.00	2,650.00	2,785.32
4.Agricult	1,790.00	1,567.20	687.10	1,490.03	2,298.60	1,433.00	637.00	1,604.06
5.Resid.	2,415.60	12,040.00	2,454.00	5,193.26	3,142.50	14,309.00	2,169.00	5,575.28
End use	9,490.00	28,496.10	7,603.80	15,228.34	11,719.60	33,538.00	8,116.00	17,473.51
Auxiliar.	655.60			198.33	1,437.50			453.55
Row mater.			1,234.10	1,234.10			1,934.00	1,934.00
Losses	1,370.00	927.10	92.70	661.80	1,584.50	1,178.00	117.00	815.72
Other	44.40	130.00	112.30	147.42		7.00	727.00	728.18
Total con	11,560.00	29,553.20	9,042.90	17,469.99	14,741.60	34,723.00	10,894.00	21,404.96
Produc.	11,665.50	29,553.20			20,962.40	34,723.00		
Con of res				17,501.90				23,367.68
Needs				17,467.17				21,404.96
Ex of el.				17,488.92				22,602.52
Con of ind.				7,178.70				9,515.96
Fuel for pr.			302.51				315.51	
			166.82				168.76	

BEST AVAILABLE COPY

	1990 Electricity mln.kWh	Heat th.Gcal	Fuel th.t c.e.	Total th.t c.e.
1.Industry	5,923.90	16,457.00	2,151.00	6,800.17
its branch:				
a)fuel	456.60	1,728.00	753.00	1,188.42
b)chemic.	1,186.70	3,223.00	104.00	1,022.97
c)machin.	1,246.70	2,295.00	96.00	378.45
d)paper &	560.60	2,120.00	57.00	591.33
e)build.	901.60	2,411.00	980.00	1,671.37
f)light	613.90	1,196.00	10.00	406.35
g)food	483.60	2,987.00	74.00	729.21
h)rest	474.20	497.00	77.00	311.57
2.Constr.	257.30	648.00	152.00	342.79
3.Transp.	247.10	212.00	2,413.00	2,527.35
4.Agricult	2,696.90	1,911.00	639.00	1,319.44
5.Resid.	3,644.40	13,496.00	2,429.00	5,854.70
End use	12,769.80	32,724.00	7,784.00	17,344.45
Auxiliar.	2,108.20			672.20
Raw mater.			972.00	972.00
Losses	1,552.00	1,444.00	337.00	1,074.06
Other		6.00	1,071.00	1,072.01
Total con	16,430.00	34,174.00	10,164.00	21,134.72
Produc.	28,403.00	34,174.00		
Con of res				24,952.31
Needs				21,134.72
Ex of el.				23,479.63
Con of ind.				3,444.37
Fuel for pr.			318.85	
			167.73	

BEST AVAILABLE COPY

TABLE 7

Consumption of electricity, heat, fuel and final energy

	1960 Electricity mln. kWh	1960 Heat th.Gcal	1960 Fuel th.t o.e.	1960 Fin.energy th.t o.e.	1965 Electricity mln. kWh	1965 Heat th.Gcal	1965 Fuel th.t o.e.	1965 Fin.energy th.t o.e.
1.Industry	562.80	1,264.00	556.57	731.38	1,401.70	4,347.20	528.67	1,083.95
its branches:								
a) oil refinery		7.00	34.27	34.97	17.30	34.00	26.57	31.46
b) ind. chemicals	4.40	137.50	4.55	18.68	213.00	521.00	8.74	79.16
c) machinery	122.00	128.40	32.17	55.50	313.30	420.00	36.78	105.73
d) paper & its pr.	108.00	196.00	3.50	32.39	204.70	620.00	2.17	81.78
e) building mater.	102.00	127.80	293.71	315.26	217.90	780.00	321.68	418.42
f) light industry	87.10	186.00	1.47	27.56	162.10	660.00	.77	81.71
g) food industry	117.90	426.00	141.82	194.56	135.60	1,180.00	112.59	242.25
h) rest of industry	21.40	55.30	45.08	52.45	137.80	132.20	19.37	44.44
2.Construction	26.60	12.30	93.85	97.37	46.10	114.50	104.91	120.32
3.Transport	25.10	8.70	873.99	877.02	46.20	91.50	1,111.40	1,124.52
4.Agriculture	60.60	28.10	187.76	195.78	184.30	30.00	332.17	351.02
5.Residential	284.00	677.90	1,347.06	1,439.28	571.70	1,969.70	1,462.38	1,708.52
End use	959.10	1,991.00	3,059.23	3,340.83	2,250.00	6,552.90	3,539.52	4,388.33
Auxiliaries	62.50			5.38	255.30			21.96
Row material			30.77	30.77			107.83	107.83
Losses	108.30	82.40	23.50	41.05	382.60	44.20	57.83	95.16
Other						281.50	67.48	95.63
Total consumption	1,129.90	2,073.40	3,113.50	3,418.03	2,887.90	6,878.60	3,772.66	4,708.91
Production	1,122.00				3,851.10			
Losses of electr. generation				275.99				572.43
Losses of heat generation				150.89				259.46
Total consumption of resources				3,844.91				5,623.65
Needs of Lithuania				3,845.88				5,397.64
Consumption with losses for export				3,844.91				5,540.80
Total consumption of industrie				767.53				1,213.74
Relative consumption of fuel for prod.			86.01				86.01	
			100.00				100.00	
			331.99				234.65	

BEST AVAILABLE COPY

	1970				1979			
	Electricity min.kWh	Heat th.Gcal	Fuel th.t o.e.	Fin.energy th.t o.e.	Electricity min.kWh	Heat th.Gcal	Fuel th.t o.e.	Fin.energy th.t o.e
1.Industry	2,461.80	7,860.00	847.41	1,845.15	4,138.10	11,724.10	1,152.87	2,661.20
its branch:								
a)oil ref	28.30	87.90	12.52	23.74	22.10	53.80	10.91	18.19
b)ind.ch.	612.10	1,423.00	24.69	219.64	1,181.70	2,742.10	22.66	398.51
c)machin.	587.40	1,145.00	59.44	224.46	977.30	1,426.10	86.29	304.36
d)paper &	276.20	1,007.00	16.78	141.24	451.10	1,416.00	26.95	217.37
e)build	375.60	1,383.00	520.73	691.39	694.70	2,192.30	740.84	[illegible]
f)light	297.00	1,126.00	3.99	142.13	428.40	1,485.00	5.77	191.38
g)food	183.30	1,507.60	157.34	323.41	261.90	2,176.40	187.48	427.65
h)rest	101.40	185.50	51.67	78.94	220.90	231.80	51.97	94.14
2.Const.	75.30	368.10	178.18	221.47	101.60	512.30	146.71	206.68
3.Transp.	107.00	150.00	1,309.72	1,333.92	170.30	180.00	1,501.12	1,533.77
4.Agric.	422.20	95.90	397.48	443.38	933.60	230.60	450.34	554.20
5.Resid.	1,052.30	3,796.50	1,578.67	2,048.83	1,717.80	8,309.10	1,593.78	2,572.44
End use	4,118.60	12,270.50	4,311.46	5,892.75	7,061.40	20,956.10	4,825.32	7,528.29
Auxil.	428.20			36.83	507.20			43.62
Raw mat.			287.97	287.97			463.15	463.15
Losses	639.60	398.60	37.41	132.28	907.60	626.40	44.41	185.11
Other		250.00	80.00	105.00		220.00	168.95	190.95
Total	5,186.40	12,919.10	4,716.84	6,454.83	8,476.20	21,802.50	5,501.83	8,411.12
Produc.	7,362.90	12,919.10			8,993.20	21,802.50		
El.gen.				1,000.32				1,124.15
Heat gen				308.52				372.47
Con of res.				7,950.88				9,952.21
Needs				7,467.98				9,843.12
Con + exp				7,783.67				9,907.74
Con of ind				2,169.95				3,167.97
Fuel f. proc			86.01				86.01	
			100.00				100.00	
			221.87				211.01	

BEST AVAILABLE COPY

	1980				1985			
	Electricity mln.kWh	Heat th.t o.e.	Fuel th.t o.e.	Fin.energy th.t o.e.	Electricity mln.kWh	Heat th.Gcal	Fuel th.t o.e.	Fin.energy th.t o.e.
1.Industry	4,844.40	14,064.80	1,352.80	3,175.95	5,766.30	17,001.00	1,706.29	3,902.35
its branch:								
a)oil ref	50.00	345.60	64.97	103.83	250.00	1,378.00	194.41	353.71
b)ind.ch.	1,280.00	2,896.40	57.20	456.93	1,456.20	3,555.00	178.32	659.07
c)mach.	1,030.00	1,884.10	96.64	373.64	1,170.60	2,273.00	76.22	404.20
d)cedar 1	460.00	1,899.30	35.38	264.87	531.60	2,073.00	30.77	283.79
e)build.	810.00	2,529.30	859.09	1,181.69	850.40	2,621.00	1,050.35	1,385.59
f)light	520.00	1,735.40	4.69	222.96	599.00	1,701.00		221.62
g)food	330.00	2,374.50	222.17	488.00	441.60	3,007.00	125.87	464.55
h)rest	364.40	400.20	12.66	84.03	466.90	393.00	50.35	129.82
2.Constr.	210.00	581.50	154.76	230.97	258.20	468.00	153.85	222.86
3.Transp.	230.00	242.60	1,613.22	1,657.26	254.00	327.00	1,853.15	1,907.70
4.Agricult	1,790.00	1,567.20	480.49	791.17	2,298.60	1,433.00	445.45	786.45
5.Resid.	2,415.60	12,040.00	1,716.08	3,127.85	3,142.50	14,309.00	1,516.78	3,217.97
End use	9,490.00	28,496.10	5,317.35	8,983.20	11,719.60	33,538.00	5,675.52	10,037.33
Auxil.	655.60			56.39	1,437.50			123.64
Row mat.			863.01	863.01			1,352.45	1,352.45
Losses	1,370.00	927.10	64.83	275.37	1,584.50	1,178.00	81.82	335.90
Other	44.40	130.00	78.53	95.35		7.00	508.39	509.09
Total con.	11,560.00	29,553.20	6,323.72	10,273.32	14,741.60	34,723.00	7,618.18	12,358.41
Produc.	11,665.50	29,553.20			20,962.40	34,723.00		
El.gen.				1,464.49				2,822.17
Heat gen.				492.28				625.50
Con. of res				12,239.16				16,341.16
Needs				12,216.84				14,968.60
Prod - exp				12,230.09				15,806.08
Con of ind				4,095.35				5,378.44
Fuel for pr			86.01				86.01	
			100.00				100.00	
			211.55				220.64	

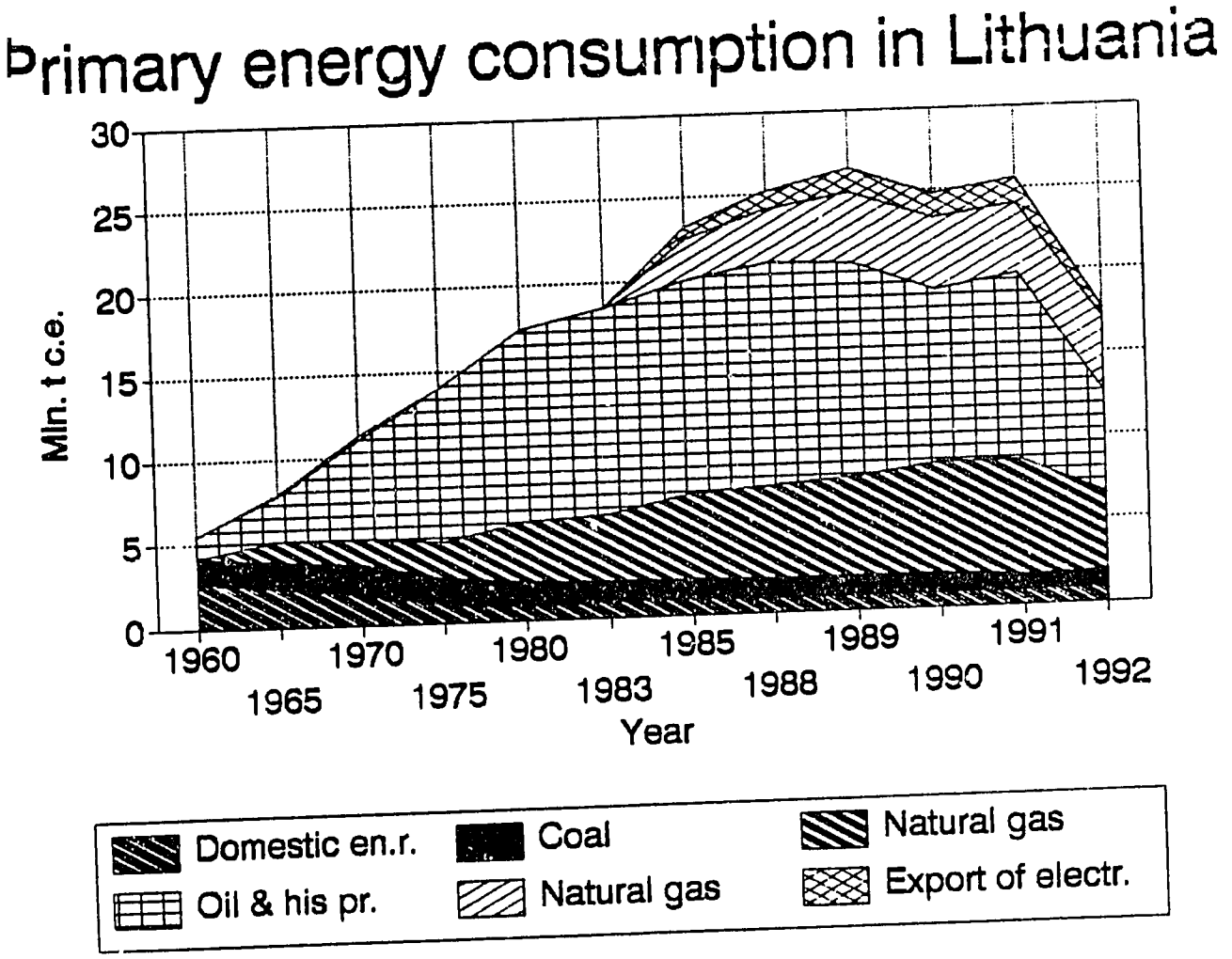
BEST AVAILABLE COPY

1990

	Electricity mln.kWh	Heat th.Gcal	Fuel th.t o.e.	Fin.energy th.t o.e.
1.Industry	5,923.90	16,457.00	1,504.20	3,659.41
its branch:				
a)oil ref	456.60	1,726.00	526.57	738.64
b)ind.ch.	1,186.70	3,223.00	72.73	497.10
c)macn.	1,246.70	2,295.00	67.13	403.86
d)paper &	360.60	2,120.00	39.56	300.08
e)build.	901.60	2,411.00	685.31	1,003.96
f)light	613.90	1,196.00	6.99	179.39
g)food	483.60	2,987.00	51.73	392.04
h)rest	474.20	497.00	53.86	144.34
2.Constr.	257.50	648.00	106.29	193.24
3.Transp.	247.10	212.00	1,687.41	1,729.86
4.Agricult	2,696.90	1,911.00	446.85	869.91
5.Resident	3,644.40	13,496.00	1,698.60	3,361.65
End use	12,769.80	32,724.00	5,443.35	9,814.07
Auxil.	2,108.20			181.33
Raw mat.			679.72	679.72
Losses	1,552.00	1,444.00	235.66	513.55
Other		6.00	748.95	749.55
Total con.	16,430.00	34,174.00	7,107.68	11,938.22
Procuc.	19,403.00	34,174.00		
El.gen.				3,390.07
Heat gen.				591.00
Con of res.				17,449.14
Needs				14,779.52
Proc - exp				16,419.29
Con of ind				4,520.46
Fuel for prod			36.01	
			100.00	
			222.97	

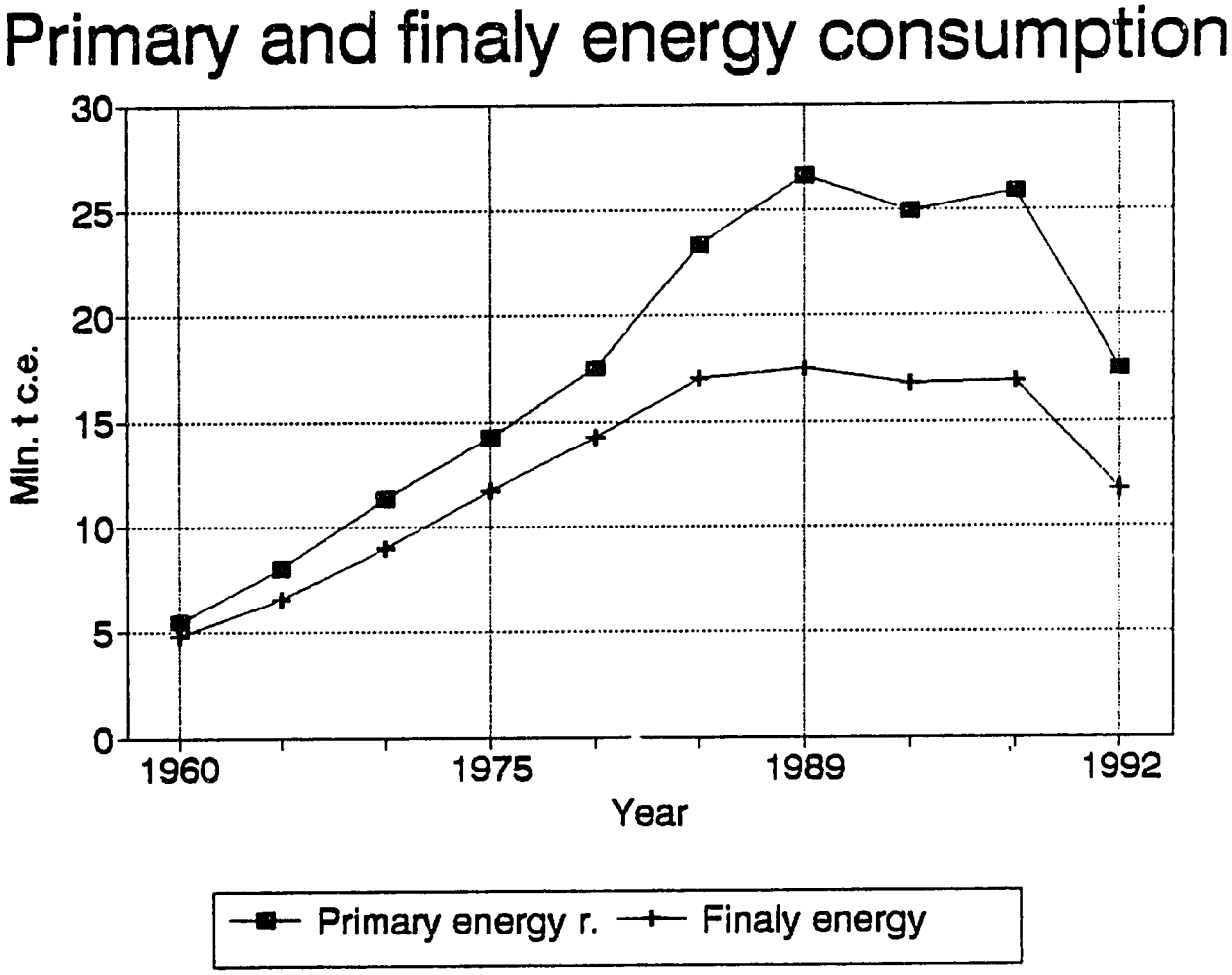
BEST AVAILABLE COPY

FIGURE 1.



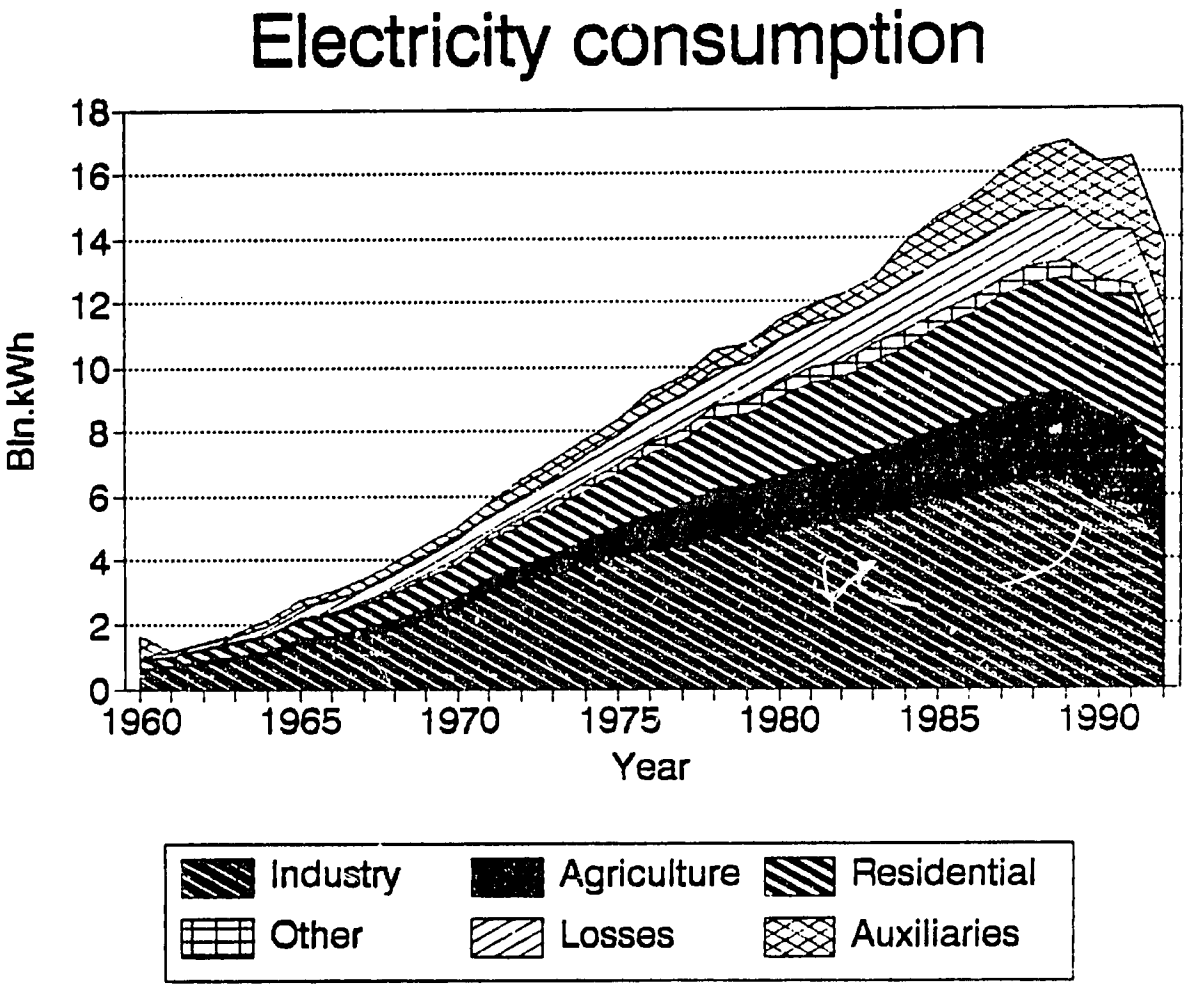
BEST AVAILABLE COPY

FIGURE 2



BEST AVAILABLE COPY

FIGURE 3.



BEST AVAILABLE COPY