

## 9.2 Simulation

### 9.2.1 Perspective of simulation

This section introduces simulation results for the macro-economy and energy supply and demand, using MEMP. Three cases (scenarios) are prepared for the simulation. The first simulation is the "Reference case," the second is the "Energy Conservation Case (EC)," and the third is the "Accelerated Energy Conservation Case (AEC)."

In addition, to know the effects of the energy pricing policy on the macro-economy and energy supply/demand, we separately conducted several simulations of energy price changes.

The "Reference Case" is used as the base line to measure the economic effects of the energy conservation policy. In other words, the "Reference Case" contrasts with other two energy-saving cases. But, this case is also designed as the "Business As Usual Case."

On the other hand, two cases which energy saving policy is taken into account are presupposed with a higher energy price and with the potential energy saving, which is obtained through the individual micro-industry analysis shown in the previous chapters in this report.

The purpose is to simulate these two cases to evaluate how the energy saving policy influences the energy supply and demand and the macro-economy through comparisons among the simulation results.

The simulation period is the seven years from 1996 to 2003.

### 9.2.2 Reference case

#### (1) Major assumptions

We assumed the major exogenous variables for the "Reference Case" as follows, and Table 9.2 gives the details.

#### a. World economy

First, we assume that the annual increase of the export price index of world trade, which means world inflation, is 2.0%. The crude oil price will be 18 dollars per a barrel (current price) in 2000 and 20 dollars in 2003, although it has been declining in recent years.

The same applies to the export coal price. The price has been stagnant, but we assume that it will recover slightly around the year 2000 and thereafter. It will be 27 dollars per ton in 2000 and 29 dollars in 2003.

**Table 9.2 Assumptions for Simulation in Reference Scenario**

(Unit, % and etc.)

Items	Variable	Unit	Actual			Assumption				
			1990	1996	96/90	2000	00/96	2003	03/00	03/96
<b>1 World Economy</b>										
a. World Trade	TWM	Bil. US\$	2,940	3,729	4.0	4,197	3.0	4,586	3.0	3.0
b. Price of Exp. Goods	PEW	1980=100	133.8	129.0	-0.6	139.6	2.0	148.2	2.0	2.0
c. World Oil Price	POILUS	US\$/bbl	22.8	18.0	-3.8	18.0	0.0	19.7	3.0	1.3
d. Export Coal Price	PEXCLD	US\$/ton	33.1	27.1	-3.3	27.1	0.0	29.2	2.5	1.1
<b>2 Economic Policy</b>										
a. Interest Rate	INT	%	50.0	21.1	-13.4	15.0	-8.2	10.0	-12.6	-10.1
b. Government Expenditure (financial expenditure)										
Capital Expenditure	GPDE	Mil. PLN	2,164	4,194	10.0	7,083	14.0	8,437	6.0	10.5
c. Exchange Rate	EXR.wb	PLN/US\$	0.77	2.70	23.2	3.89	9.6	4.34	3.7	7.0
d. Balance of Payment										
Service(net)	DSERV	Mil. US\$	-3,349	-575	-25.4	-575	0.0	-575	0.0	0.0
Transfer(net)	DTRANS	Mil. US\$	1,988	224	-30.5	224	0.0	224	0.0	0.0
<b>3 Energy Policy</b>										
a. Domestic Energy Prices (1996 constant price with WPI)										
Increasing Ratio	RENP	1996=100	-	100.0	-	100.0	0.0	100.0	0.0	0.0
Coal	PCLIN	PLN/ton	10.4	123.3	50.9	123.3	0.0	123.3	0.0	0.0
Gasoline	PGASO	PLN/L	0.28	1.50	32.4	1.28	-3.8	1.7	10.0	1.9
Electricity	PELEH	PLN/kWh	0.015	0.180	51.3	0.18	0.0	0.18	0.0	0.0
Natural Gas	PGASH	PLN/m <sup>3</sup>	0.173	0.55	21.3	0.55	0.0	0.55	0.0	0.0
Heat	PSTEAM	PLN/m <sup>2</sup>	0.042	1.69	85.1	1.69	0.0	1.69	0.0	0.0
b. Resource Development(Production)										
Coal(incl. Solid)	CLPD	1000 TOE	96,847	98,493	0.3	79,886	-5.1	74,500	-2.3	-3.9
Natural Gas	GAPD	1000 TOE	2,378	3,276	5.5	3,276	0.0	3,276	0.0	0.0
Crude Oil	CRPD	1000 TOE	175	396	14.6	396	0.0	396	0.0	0.0
Hydro Electric	HYPD	1000 TOE	284	166	-8.6	166	0.0	166	0.0	0.0
c. Input for Electricity and Heat Supply(CHP,DH)										
Hydro	HYEH	1000 TOE	-283	-166	-8.5	-166	0.0	-166	0.0	0.0
Petroleum	PTEH	1000 TOE	-1,601	-694	-13.0	-694	0.0	-694	0.0	0.0
Natural Gas	GAEH	1000 TOE	-521	-173	-16.8	-173	0.0	-1,200	90.8	31.9
d. Efficiency of Energy Conversion Sector										
Distr. Loss, Elec.	RELOFL	%	12.4	19.3	7.7	19.3	0.0	19.3	0.0	0.0
Own Use, Elec.	RELOWFL	%	33.1	27.8	-2.9	27.8	0.0	27.8	0.0	0.0
Petro. Conv. Factor	RCONVPT	%	93.1	84.5	-1.6	84.5	0.0	84.5	0.0	0.0
Cost / Sales Ratio	CRATE	%	-	-	-	0.7	0.0	0.7	0.0	-
<b>4 Social Indicators and Others</b>										
a. Population	POP	1000 P.	38,119	38,674	0.2	38,984	0.2	39,219	0.2	0.2
b. Employer and etc.	LOT	1000 P.	467	203	-13.0	203	0.0	203	0.0	0.0
c. Time Trend	TIME	1980=80	90	96	1.1	100	1.0	103	1.0	1.0
d. Transition Dummy	DUMTRANS	1990=1	1	7	38.3	11	12.0	16	13.3	12.5

**b. Macro-economic policy**

The interest rate for a yearly deposit in 2000 is assumed to be 15% and 10% in 2003, despite being 21% in 1996, because we expect inflation will gradually fall in the near future.

Governmental fixed capital formation will expand at an annual growth rate of 14% until the year 2000 and 16% after 2000.

Moreover, the supposition about the exchange rate is as follows. The figure recorded in 1996 was 2.7 PLN/US\$. It will be devalued at 9.6% annually until 2000 and at 7% after 2000, consequently it will be 3.89 PLN/US\$ in 2000 and 4.34 PLN/US\$ in 2003.

As for the international balance of payments, we assume the net service balance and the transfer balance in 1996 will be maintained.

### c. Energy policy

In the energy policy, the concrete policy measure includes (1) domestic energy prices, (2) energy conversion efficiency by the energy industry, (3) primary energy production (resource development, especially coal production), (4) power development plan, and (5) productivity of the energy industry.

#### 1) Domestic energy price

The assumption for the secondary energy price in the domestic market is as follows. We suppose that, excluding petroleum products, each of the secondary energy prices, such as coal, electric power, natural gas and heat, is stable at the constant price (in 1996 price).

When considering it in the nominal (market) price, it climbs with the pace of the wholesale price rise. However, as for the petroleum product, it is assumed to be lower until the year 2000 in terms of constant prices with consideration of a connection with the international oil market and it has a substantial raise after 2000.

#### 2) Energy conversion efficiency by the energy industry

According to statistical data 1996, the conversion efficiency from primary energy to secondary energy in the energy industry is quite low compared to those of western developed countries.

In the future, efficiency would gradually improve, but as in "Reference Case" the values in 1996 are expected to be maintained.

#### 3) Primary energy production

Coal production in 1996 was 138 million tons, which is equal to 98 MTOE (Million Tons Oil Equivalent). It is almost equal to 3/4 of 180 million tons of the peak in 1987.

Comparing the 130-million tons in 1992, which was the bottom, the production in recent years is tracing a recovery tendency.

However, our assumption for future coal production is in the opposite direction. Its figure in 2000 is 114 million tons (80 MTOE) and 106 million tons (75 MTOE) in 2003. These correspond with the governmental restructuring plan for the coal industry issued in June 1998.

As for the other primary energy carriers, such as crude oil, natural gas, and hydraulic

generation of electricity, excluding coal, production is the same as in 1996.

#### 4) Electric power development

The coal burning plant caters to the incremental supply resource that corresponds to the additional demand for electricity in future. The basic idea is to build a future plan for power supply composition.

However, beyond 2000, we take account of a substantial introduction of gas fired plants that will consume natural gas of about 1.2 MTOE at the CHP in 2003.

The future quantity of fuel for oil-fired plants is supposed to be same as in 1996, and no nuclear power plant will be operated in 2003.

The efficiency of power generation, transmission, and distribution in the future are assumed to be the same as 1996 figures.

#### 5) The productivity improvement of the energy industry

For a government that has a financial deficit, reducing the subsidy to the energy industry such as the coal industry is a critical problem. To solve the problem, it is necessary to improve the productivity of the energy industry.

Here, we assume that the ratio of a) the increase in the supply cost of the energy industry to b) the increase in general prices indicates the productivity of the energy industry calculated by other industries. The ratio in the future is 70 percent of b) inflation.

The profit caused by the productivity improvement, which is calculated as the difference between sales and supply cost, is an incremental value added. We treat it as one of the government income sources.

#### b. Social index

According to statistics in Poland, the annual growth rate of population has been 0.2% in recent years. The figure is quite small, but it has been very stable in the past few decades.

Therefore, we adopt this value as the future rate of population growth.

### (2) Simulation result

The simulation result that is computed on the basis of the assumption described above is as follows.

#### a. Macro-economy

##### 1) GDP growth

The annual growth rate of GDP in terms of constant prices from 1996 to 2000 is estimated to be 4.0% and is forecast to be 3.9% from 2000 to 2003. The growth rate after 2000 is

lower than before, because imports after 2000 will increase.

This depends on the terms of trade and on the degree the exchange rate falls. The degree of devaluation relates to the stability of domestic commodity prices, however, it also relates to the decline of the international competitiveness the Polish industries in the world market.

According to the simulation result, annual inflation from 1996 to 2000 is 10.2% based on CPI, and after 2000, it becomes 4.2%.

On the other hand, as for imports, the annual increase until 2000 is 6.8%, and after that it expands substantially at 9.2%.

Consequently, the economic scales in 2000 and in 2003 are 77 billion PLN and 87 billion PLN respectively, which are 1.17 times and 1.30 times the 1996 level; 66 billion PLN.

The per capita GDP in constant prices is 1,986 PLN in 2000 and 2,214 PLN in 2003, which are 1.16 times and 1.29 times the 1996 level; 1,712 PLN (See Table 9.3).

## 2) Prices

The high inflation rates being observed with the economic transition in the first half of the 1990s will disappear rapidly. The annual increase of consumer prices from 1996 to 2000 is computed to be 10.2% and after 2000 to be 4.2%. The reasons for this mild inflation are the stability of import prices, which accompany the stabilization of the exchange rate and the rise of productivity, which are assumptions.

Like consumer prices, the inflation rate for the wholesale price index is estimated to be 9.3% until 2000 and after that to be 0.9%.

## 3) Government financial balance

Future financial expenditure of the government will depend on the assumption that income and expenditure would be balanced. However, as for increases of supply cost of the energy industry, we set the condition of 70 % with the rate increasing with consumer prices.

Therefore, if the income increase of the energy industry becomes is above 70% of the CPI increase rate, the subsidy from the government is reduced, and the government can expend additional investment or expenditure in the market.

But, if the speed of income increase is below 70% of the rate of increase of CPI, the government must pay an additional subsidy and cannot help restraining current expenditure or public investment.

Under the "Reference case," we make the energy price increase the same as that of the wholesale price index, in other words, energy prices remain stable in terms of constant prices.

Therefore, even if energy demand does not increase temporarily, the profit - the value added - of the energy industry increases, because the costs of the energy industry increase only 70% with the consumer price increase. Then, the incremental profit expands GDP through government expenditure (See Table 9.4).

**Table 9.3 Simulation Result of GDP Component (Reference Scenario)**

(Unit: Million PLN, 1990=100,%)

Variable	Mean	Actual			Simulation Results				
		1990	1996	'96/'90	2000	'00/'96	2003	'03/'00	'03/'96
CP	Private Expenditure	26,867	37,034	5.5	43,127	3.9	48,401	3.9	3.9
CG	Government Consumption	10,808	14,478	5.0	13,815	-1.2	13,510	-0.7	-1.0
I	Investment Total (IP + IG)	14,351	19,020	4.8	24,135	6.1	30,565	8.2	7.0
IP	Private Investment	7,774	9,575	3.5	13,163	8.3	17,787	10.6	9.3
IG	Government Investment	6,577	9,444	6.2	10,972	3.8	12,778	5.2	4.4
J	Stock Change	2,590	392	-27.0	356	-2.4	377	2.0	-0.5
E	Export Total(EXCL+EXOT)	16,051	26,500	8.7	36,468	8.3	46,599	8.5	8.4
EXCL	Export Coal	919	1,071	2.6	248	-30.7	0	-100.0	-100.0
EXOT	Export Others	15,132	25,428	9.0	36,221	9.2	46,598	8.8	9.0
M	Import Total(MOG+MOT)	12,050	30,753	16.9	40,044	6.8	52,193	9.2	7.8
MOG	Import Oil & Gas	1,285	1,322	0.5	1,830	8.5	2,193	6.2	7.5
MOT	Import Others	10,765	29,430	18.2	38,214	6.7	50,000	9.4	7.9
SD	Statistical Difference	-2,590	-392	-27.0	-392	0.0	-392	0.0	0.0
GDP	Gross Domestic Expenditure	56,027	66,278	2.8	77,466	4.0	86,867	3.9	3.9
WPI	Wholesale Price Index	100	475	29.7	678	9.3	695	0.9	5.6
CPI	Consumer Price Index	100	660	36.9	972	10.2	1,101	4.2	7.6
WI	Average wage Index	100	567	33.5	902	12.3	1,049	5.2	9.2

**Table 9.4 Government Financial Balance**

(Unit: Million PLN, %)

Variable	Mean	Actual			Simulation Results				
		1990	1996	'96/'90	2000	'00/'96	2003	'03/'00	'03/'96
GRTAX	Revenue Source by Taxes	16,680	90,090	32.5	142,102	12.1	143,278	0.3	6.9
GROTR	Revenue Sources by Others	3,030	8,413	18.6	13,351	12.2	16,403	7.1	10.0
INENE	Incremental Revenue to 1995	0	-2726	-	8,401	-	21,447	36.7	-234.3
GRT	Government Revenue Total	19,710	98,503	30.8	163,855	13.6	181,128	3.4	9.1
GPCE	Payment for Current Expenses	17,155	104,468	35.1	157,147	10.7	173,138	3.3	7.5
GPDE	Payment for Capital Expenditure	2,164	4,194	11.7	6,708	12.5	7,990	6.0	9.6
GPT	Government Payment Total	19,319	108,661	33.4	163,855	10.8	181,128	3.4	7.6
GRPD	Financial Balance	392	-10,159	-	0	-100.0	0	-	-
MLM2	Money Supply	19,060	134,880	38.6	210,424	11.8	236,623	4.0	8.4

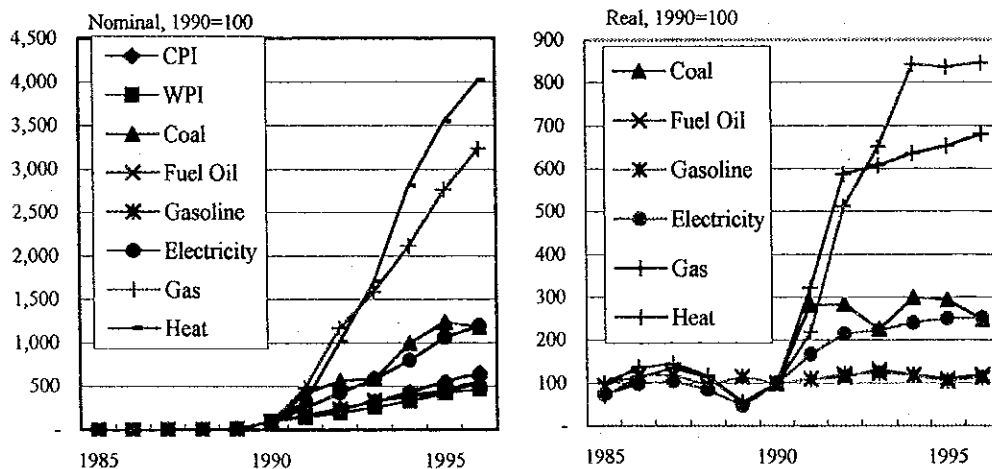
b. Primary energy supply

1) Primary energy total

The first half of the 1990s was an era of economic revival. In that era, economic growth did not so trigger energy consumption in the process of the recovery. In the period from 1990 to 1996, the annual economic growth rate was 2.8%, whereas the primary energy supply increased 1.1% annually. This de-coupling was caused by a change in the industrial structure, the improvement of the energy efficiency in the energy industry, and the rationalization of the production facilities in the industry. For details, refer to chapter one of this report.

The substantial increase of energy price rise was also reason. The coal price for the industry rose 66%/a year, and electric power and steam for home rose 61%/a year and 104%/a year respectively from 1990 to 1996. However, the inflation rate, based on the wholesale price index, shows a 30%/ a year in the same period. There is suspicion that this big energy price rise contributed to the industrial structure change and the energy efficiency improvement (See Figure 9.5).

**Figure 9.5 Trends of Domestic Energy Prices**



(note) Figures in real term are calculated by deflating with WPI.

However, in the "Reference case," because it is not assumed that the energy price had a substantial rise, the tremendous energy savings in the first half of the 1990s are not projected. The expansion of economic activity increases domestic energy demand steadily.

But, energy demand in 1996 became remarkably estranged from the tendency of the first half of 1990s and increased 9.6% over the previous year. Therefore, the rate of increase until 2000 from 1996 for the estimate is small in the computation.

According to the projection, the annual increase of primary energy supply -requirement- from 1996 to 2000 is 0.8%, although it is 2.5% from 1995 to 2000, and after 2000 it is

2.4%.

Hence, the primary energy requirement, which was 108 MTOE in 1996, increases to 112 MTOE in 2000, moreover, it reaches 120 MTOE in 2003, which are 1.03 times and 1.10 times the volume in 1996 (See Table 9.5).

**Table 9.5 Simulation Result of the Primary Energy Requirement (Reference Scenario)**

(Unit: 1000 TOE, %, and etc.)

Item	Actual			Simulation Results				
	1990	1996	'96/'90	2000	'00/'96	2003	'03/'00	'03/'96
Coal (incl. Solid Fuel)	78,520 (78)	79,787 (74)	0.3	76,280 (68)	-1.1	78,039 (65)	0.8	-0.3
Oil	13,592 (13)	18,800 (17)	5.6	21,557 (19)	3.5	23,317 (19)	2.7	3.1
Electricity	-89 0	-269 0	20.1	-241 0	-2.7	-241 0	0.0	-1.5
Gas	8,915 (9)	9,645 (9)	1.3	13,918 (12)	9.6	18,566 (15)	10.1	9.8
Hydro	283 0	166 0	-8.5	163 0	-0.5	163 0	0.0	-0.3
Total	101,221 (100)	108,130 (100)	1.1	111,677 (100)	0.8	119,843 (100)	2.4	1.5
GDP(Mil. PLN, in 1990 price)	56,027	66,278	2.8	77,466	4.0	86,867	3.9	3.9
GDP Intensity(kg/PLN)	1.81	1.63	-1.7	1.44	-3.0	1.38	-1.5	-2.4
Energy-GDP Elasticity			0.4		0.2		0.6	0.4
Population(1000 person)	38,119	38,686	0.2	38,997	0.2	39,231	0.2	0.2
Energy Intensity per Capita(kg)	2,655	2,795	0.9	2,864	0.6	3,055	2.2	1.3
CO2 Emissions (Mil. Ton-C)	104.0	110.5	1.0	112	0.3	118	1.9	1.0
Per Capita CO2(kg-C)	2,727	2,857	0.8	2,869	0.1	3,016	1.7	0.8

(note) Figures in parentheses show percentage shares of total.

The energy/GDP elasticity, the ratio between the increasing rate of primary energy supply and that of GDP up to 2000 is 0.2 and after 2000 is 0.6. The major reasons for the higher elasticity after 2000 than before 2000 are (1) that energy demand observed in 1996 is exceptionally large, and (2) energy demand in the commercial sector after 2000 will expand.

Moreover, the CO<sub>2</sub> emission is projected to be 112 million tons-C in 2000 and 118 million tons-C in 2003, compared to 111 million tons-C in 1996. These amounts are 8% and 16% bigger than in 1990.

## 2) Composition by energy source

Looking at compositions by energy carriers in the primary energy supply, whereas coal took 74% in 1996, it is projected to decline to 68% in 2000 and 65% in 2003. Conversely, energy carriers whose share will increase are gas and oil. The share of gas in



1996 was 9%, but it is estimated to be 12% in 2000 and 15% in 2003. Also, oil is expected to increase its share 19% in both 2000 and 2003 from 17% in 1996.

There are two reasons underlying these trends.

First, it is estimated that the shift to gas, oil, and electricity from coal is developing final energy demand in the industrial sector and the residential/commercial sector.

Second, the increase of energy demand in the transportation sector is a big driving force, where oil is the dominant energy carrier, with the expansion of the car population. The car population was 7.9 million units in 1995 and is estimated to reach to 9.5 million units in 2000 and 10.8 million units in 2003.

### c. Final energy consumption

#### 1) Composition by the energy source

The annual increasing rate of final energy consumption from 1996 to 2000 is 1.0 % and it is 1.6 % from 2000 to 2003. In order of increase by the energy source, it is gas, petroleum, and electricity (See Table 9.6).

**Table 9.6 Simulation Result of the Final Energy Demand (Reference Scenario)**

energy/sector	(Unit: 1000 TOE, %)							
	Actual			Simulation Results				
	1990	1996	'96/'90	2000	'00/'96	2003	'03/'00	'03/'96
Coal (incl. Solid Fuel)	28,462 (41)	30,564 (42)	1.2	26,261 (35)	-3.7	24,747 (31)	-2.0	-3.0
Petroleum	11,336 (16)	15,928 (22)	5.8	19,154 (25)	4.7	20339 (26)	2.0	3.6
Gas	4,971 (7)	8,454 (12)	9.3	12,122 (16)	9.4	15138 (19)	7.7	8.7
Electricity	7,323 (11)	8,035 (11)	1.6	9,360 (12)	3.9	10551 (13)	4.1	4.0
Heat	17,227 (25)	10,028 (14)	-8.6	8,999 (12)	-2.7	8720 (11)	-1.0	-2.0
Total	69,319 (100)	73,009 (100)	0.9	75,896 (100)	1.0	79494 (100)	1.6	1.2
Industrial Sector	24,708 (36)	25,325 (35)	0.4	25,502 (34)	0.2	26,728 (34)	1.6	0.8
Transportation Sector	8,063 (12)	9,920 (14)	3.5	10,931 (14)	2.5	11454 (14)	1.6	2.1
Agriculture	5,115 (7)	5,166 (7)	0.2	4,912 (6)	-1.3	4960 (6)	0.3	-0.6
Commercial	6,971 (10)	4,654 (6)	-6.5	4,956 (7)	1.6	5416 (7)	3.0	2.2
Residential	20,236 (29)	24,062 (33)	2.9	24,979 (33)	0.9	26336 (33)	1.8	1.3
Non-energy Use(Incl. feed stock)	4,227 (6)	3,882 (5)	-1.4	4,616 (6)	4.4	4601 (6)	-0.1	2.5

(note) Figures in parentheses show percentage shares of total.

Gas increases mainly in the industrial sector, and an increase of 8.7 % in annual rate is expected from 1996 to 2003. The share of gas of final energy consumption will reach 16 % in 2000 and 19 % in 2003 from 12 % in 1996.

A higher increase for oil is projected in the transportation sector, the residential/commercial sector, and the industrial sector, and an annual 4.7% increase is expected until 2000, and 2.2% after that.

However, it is projected coal will decline gradually by -3.7% and later by -2.0 %. But, this is related to the issue by which energy carrier compensates heat demand in final energy consumption.

When an industrial customer supplies heat self-sufficiently, the energy as a final energy carrier listed in the statistics is not heat, but coal, oil or gas, which is the fuel input to the boiler to generate heat.

Conversely, when the supplier of heat is an energy industry, mainly a district heating company, heat is consumed as a final energy source by users, and the fuel input to produce heat is not listed as a final energy statistically but as the fuel input to the energy conversion sector.

We can recognize a tendency in the 1990s of industrial consumers tending not to purchase heat from outside, but to have boilers and to produce heat at their own sites. Therefore, in the final energy consumption, heat demand decreases, and fuels for producing the heat tend to expand. In addition, the fuel, which is input, tends to shift from coal to oil and gas.

## 2) Composition by demand sector

The commercial sector is where the biggest growth is expected, when viewing final energy consumption by demand sector, the transportation sector follows. The annual growth rates of energy consumption in these sectors are projected to be 2.2% and 2.1% respectively through out the simulation period.

The third biggest increase expected is in the residential sector followed by the industrial sector.

The reason that the transportation sector shows relatively large growth rate is because there is strong car demand. In the industrial sector, the future demand for energy is expected to grow slightly, although a production revival and an expansion of industrial activities are expected in the future, because the 1996 level is irregularly high.

### d. Energy consumption in the industrial sector

The annual increasing ratio of energy consumption in the industrial sector is estimated to be 0.2% up to 2000 and is 1.6% after 2000 (Table 9.7).

The important factors that influence energy consumption in this sector are: first, how much industry of Poland expands, second, how much heavy industry, which is an energy intensive industry, grows, and third, how fast energy-saving processes are introduced into factories?

The aggregated average production index for industry, which is estimated from the GDP projection, is showing a 3.2% annual growth rate up to 2000 and 3.7% after 2000. The data observed from 1990 to 1996 shows only an increase of 0.6% for annual rates.

In the future, the production expansion of 3% to 4% annually is projected for the material industry. Moreover, as for the energy-saving factor, because the energy price is constant in constant prices, a big development cannot be expected and it depends only on technological improvement, which is a function of the time trend.

**Table 9.7 Simulation Result of Energy Demand in the Industrial Sector (Reference Scenario)**

(Unit: 1000 TOE, %)

Energy Source	Actual			Simulation Results				
	1990	1996	'96/'90	2000	'00/'96	2003	'03/'00	'03/'96
Coal	8,518 (34)	14,463 (57)	9.2	12,232 (48)	-4.1	10,666 (40)	-4.5	-4.3
Electricity	3,234 (13)	3,971 (16)	3.5	4,391 (17)	2.5	5,038 (19)	4.7	3.5
Gas	2,438 (10)	2,552 (10)	0.8	3,676 (14)	9.6	4,999 (19)	10.8	10.1
Heat	9,734 (39)	2,516 (10)	-20.2	2,374 (9)	-1.4	2,070 (8)	-4.5	-2.7
Petroleum	784 (3)	1,823 (7)	15.1	2,828 (11)	11.6	3,954 (15)	11.8	11.7
Total	24,708 (100)	25,325 (100)	0.4	25,502 (100)	0.2	26,728 (100)	1.6	0.8
Iron and Steel	7,816	5,681	-5.2	7,186	6.1	7,680	2.2	4.4
Chemicals	2,790	4,432	8.0	4,338	-0.5	4394	0.4	-0.1
Non-ferrous Metal	571	828	6.4	461	-13.6	520	4.1	-6.4
Non-metallic Mineral	3,514	3,646	0.6	4,160	3.4	4467	2.4	2.9
Transportation Equipment	603	709	2.7	856	4.8	981	4.6	4.8
Machinery	2,231	1,535	-6.0	1,735	3.1	1877	2.6	2.9
Mining and Quarrying	1,452	694	-11.6	1,222	15.2	1199	-0.6	8.1
Food and Tobacco	2,364	3,485	6.7	2,414	-8.8	2,407	-0.1	-5.2
Paper and Pulp	1,008	1,250	3.7	1,010	-5.2	1,018	0.3	-2.9
Wood and Wood Products	446	654	6.6	532	-5.1	570	2.4	-2.0
Construction	763	575	-4.6	580	0.2	615	2.0	1.0
Textiles	1,043	1,134	1.4	897	-5.7	883	-0.5	-3.5
Other Industries	108	702	36.7	111	-37.0	117	1.9	-22.5

(note) Figures in parentheses show percentage shares of total.

## 9.2.3 Energy Conservation scenario and Accelerated Energy Conservation scenario

### (1) Assumption

To evaluate an energy conservation policy, we prepare two cases, "Energy Conservation scenario; EC" and "Accelerated Energy Conservation scenario; AEC." These cases that have taken account of the effects of the rise of energy prices, of the energy-saving potential that is examined in chapter six, and of the accelerated improvement of productivity in the energy industry, compared to the "Reference scenario."

Table 9.8 shows the concrete figures for the assumption.

**Table 9.8 Assumption of Simulation for the Energy Conservation Scenarios**

(Unit: %, and etc.)

Items	Unit	Actual		Assumption													
		1996	Reference				E.C.				A.E.C.						
			2000	00/96	2003	03/00	03/96	2000	00/96	2003	03/00	03/96	2000	00/96	2003	03/00	03/96
<i>Energy Policy</i>																	
a. Domestic Energy Prices (1996 constant price with WPI)																	
same as E.C. Case																	
Increasing Ratio(avg.) 1996=100		100.0	92.9	-1.8	102.5	3.3	0.4	102.4	0.6	120.1	5.5	2.7	102.4	0.6	120.1	5.5	2.7
for Coal	1996=100	100.0	100.0	0.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0
for Heavy Oil	1996=100	100.0	74.5	-7.1	99.1	10.0	-0.1	74.5	-7.1	99.1	10.0	-0.1	74.5	-7.1	99.1	10.0	-0.1
for Light F Oil	1996=100	100.0	85.6	-3.8	114.0	10.0	1.9	85.6	-3.8	114.0	10.0	1.9	85.6	-3.8	114.0	10.0	1.9
for Electricity	1996=100	100.0	100.0	0.0	100.0	0.0	0.0	139.1	8.6	164.3	5.7	7.3	139.1	8.6	164.3	5.7	7.3
for Gas	1996=100	100.0	100.0	0.0	100.0	0.0	0.0	112.1	2.9	124.7	3.6	3.2	112.1	2.9	124.7	3.6	3.2
for Heat	1996=100	100.0	100.0	0.0	100.0	0.0	0.0	112.1	2.9	124.7	3.6	3.2	112.1	2.9	124.7	3.6	3.2
b. Efficiency of Energy Conversion Sector																	
Distr. Loss, Elec.	%	19.3	19.3	0.0	19.3	0.0	0.0	16.4	-4.0	14.5	-4.0	-4.0	15.1	-6.0	12.5	-6.0	-6.0
Own Use, Elec.	%	27.8	27.8	0.0	27.8	0.0	0.0	25.1	-2.5	23.3	-2.5	-2.5	22.6	-5.0	19.4	-5.0	-5.0
Petro. Conv. Factor	%	84.5	84.5	0.0	84.5	0.0	0.0	87.9	1.0	90.6	1.0	1.0	89.7	1.5	93.8	1.5	1.5
Cost / Sales Ratio	-	-	0.70	-	0.70	-	-	0.50	-	0.50	-	-	0.40	-	0.40	-	-
c. Subsidiary, Tax Credit, and etc.																	
to promote energy Conservation					non					non					yes		

### a. Secondly energy prices

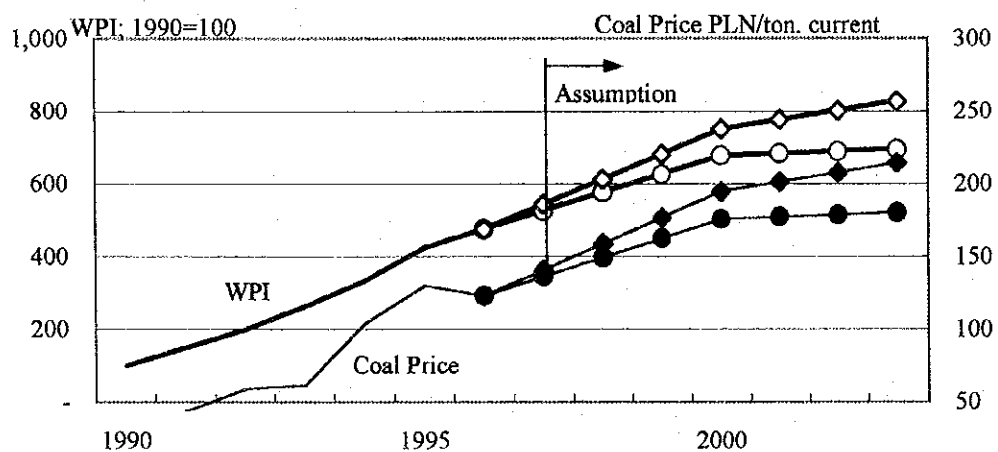
The assumptions for the domestic energy price are as follows. Using the average in the simulation period, we assume that the electricity price will rise at 7% of annual rates (constant price) and the gas price about 3% (as same) in both of the "EC scenario" and the "AEC scenario."

If the domestic energy price rises, it is quite natural that other commodity prices will also rise. Therefore, the rises with the constant price base and the nominal base become

quite big. Using this climbing ratio, the coal price in the industrial sector in 2000 is 194 PLN/ton (nominal base), which is 1.6 times the 123 PLN/ton in 1996 and in 2003 is 213 PLN/ton, 1.7 times the 1996 level.

Comparing these coal prices to those of the "Reference scenario," they are 1.1 times in 2000 and 1.2 times in 2003, since the figures for the "Reference scenario" are 176 PLN/ton (nominal base) in 2000 and 180 PLN/ton (same as above) in 2003 (Figure 9.6).

**Figure 9.6 Assumption of Energy Prices in the Scenarios**



b. Adoption of energy intensity

Increasing energy price stimulates improved energy intensity in the industrial sector through the price elasticity in the model. However, this improvement is not always equal to the intensity's improvement estimated in the micro-analysis conducted in the chapter six. Therefore, in order to keep consistency with a micro-industry analysis, we use the following procedure and set energy intensities for the "EC" and the "AEC."

First, we estimate the improvement degree of energy intensity that the increase of the domestic energy price brings about using the MEMP.

Next, we compare the above results with the intensity improvement estimated by the micro-industry analysis. When the intensity improvement degree of the latter is bigger

than the former, we can judge that the difference is an effect of the policy inducement, excluding the price effect, then we put it in the model (See Table 9.9).

**Table 9.9 Energy Intensities Adopted in the EC and AEC Scenarios**

(Unit:1996=100, %.)

Industry	Actual		Price EC(MEMP Results)				EC(Micro Analysis)				AEC(Micro Analysis)						
	1996	'96/'90	2000	'00/'96	2003	'03/'00	'03/'96	2000	'00/'96	2003	'03/'00	'03/'96	2000	'00/'96	2003	'03/'00	'03/'96
Iron and Steel	100.0	-4.5	108.7	2.1	107.9	-0.2	1.1	86.7	-3.5	77.0	-3.9	-3.7	83.2	-4.5	72.3	-4.6	-4.5
Chemicals	100.0	9.7	89.5	-2.7	85.5	-1.5	-2.2	89.7	-2.69	85.3	-1.6	-2.2	83.7	-4.3	77.7	-2.5	-3.5
Non-ferrous Metal	100.0	5.6	31.2	-25.3	27.4	-4.2	-16.9	31.2	-25.3	27.1	-4.7	-17	31.2	-25.3	25.8	-6.2	-17.6
Non-metallic Mineral	100.0	-2.5	96.4	-0.9	94.3	-0.7	-0.8	76.7	-6.42	66.5	-4.7	-5.7	72.2	-7.8	59.6	-6.2	-7.1
Transportation Equipment	100.0	-18.4	104.3	1.1	104.6	0.1	0.6	73.6	-7.39	63.7	-4.7	-6.2	69.4	-8.7	58.0	-5.8	-7.5
Machinery	100.0	20.5	106.3	1.5	90.2	-5.3	-1.5	74.4	-7.14	58.8	-7.5	-7.3	70.5	-8.4	57.7	-6.5	-7.6
Mining and Quarrying	100.0	-12.7	199.7	18.9	199.1	-0.1	10.3	78.7	-5.8*	67.9	-4.8*	-5.4	74.5	-7.1*	62.7	-5.6*	-6.5
Food and Tobacco	100.0	23.3	70.2	-8.5	73.1	1.4	-4.4	74.3	-7.16	60.5	-6.6	-6.9	68.3	-9.1	55.0	-7.8	-8.2
Paper and Pulp	100.0	1.9	73.9	-7.3	67.4	-3.0	-5.5	78.7	-5.8*	67.9	-4.8*	-5.4	74.5	-7.1*	62.7	-5.6*	-6.5
Wood and Wood Products	100.0	15.8	73.9	-7.3	77.9	1.8	-3.5	78.7	-5.8*	67.9	-4.8*	-5.4	74.5	-7.1*	62.7	-5.6*	-6.5
Construction	100.0	-11.6	72.9	-7.6	56.9	-7.9	-7.7	78.7	-5.8*	67.9	-4.8*	-5.4	74.5	-7.1*	62.7	-5.6*	-6.5
Textiles	100.0	21.6	103.3	0.8	117.6	4.4	2.3	78.7	-5.8*	67.9	-4.8*	-5.4	74.5	-7.1*	62.7	-5.6*	-6.5
Other Industries	100.0	53.3	13.5	-39.4	12.7	-2.0	-25.5	13.5	-39.4	11.6	-4.8*	-2.6	13.5	-39.4	11.4	-5.6*	-26.7

(note) Figure with "\*" is an average from the micro-analysis.

As for the energy intensity of the industry that is not covered by the micro-industry analysis, we take account of the similar improvement of the intensity that is subjected to the micro-industry analysis.

c. The efficiency improvement and the productivity improvement in the energy industry

As for the energy conversion efficiency in the energy supply industry, we expect a slight improvement compared to the "Reference scenario." Concretely, the loss percentage for transmission and distribution of electric power supply, own-use percentage in power plants, and conversion loss percentage in the oil refining industry are subjects to be considered. The assumptions are an improvement of a few percentages of annual rates respectively, although in the "Reference scenario" we make them same as the value in 1996

Moreover, as for the productivity of the energy industry, we make the ratio, which is a figure between the increasing rate of supply cost for the energy industry and the escalation rate of CPI, around 50%.

Because the figure in the "the reference scenario" is 70 percent, the productivity

improvement of the "EC" and "AEC" are assumed to be higher than that of the "Reference scenario."

(2) Simulation result

When we see the simulation result of the "EC" and the "AEC" scenarios from the comparison with that of the "Reference" scenario, following differences can be pointed out.

a. Macro-economy

1) GDP

The annual GDP growth rates of the "EC" and the "AEC" scenarios are 0.2 to 0.3 points higher than that of the "Reference" scenario through the simulation period 1996-2003. The figures are "Reference scenario" 3.9%/a year, the "EC scenario" 4.1% and the "AEC scenario" 4.2%.

As for the absolute GDP in 2003, the "EC" and the "AEC" scenarios are 1% and 2% higher than that in the "Reference scenario" (Table 9.10 and Figure 9.7).

Because the growth rate of the population is 0.2% annually, the GDP per capita in 2003 is projected to be 2,235 PLN in the "EC" and 2,253 PLN in the "AEC" scenarios (2,214 PLN in the "Reference scenario"). Comparing these values with the actual value in 1996, then are 1.30 times and 1.32 times, respectively.

This upper shift is due to the following two reasons.

First, the decrease of import energy which accompanies domestic energy savings and increase of coal exports due to the same reason.

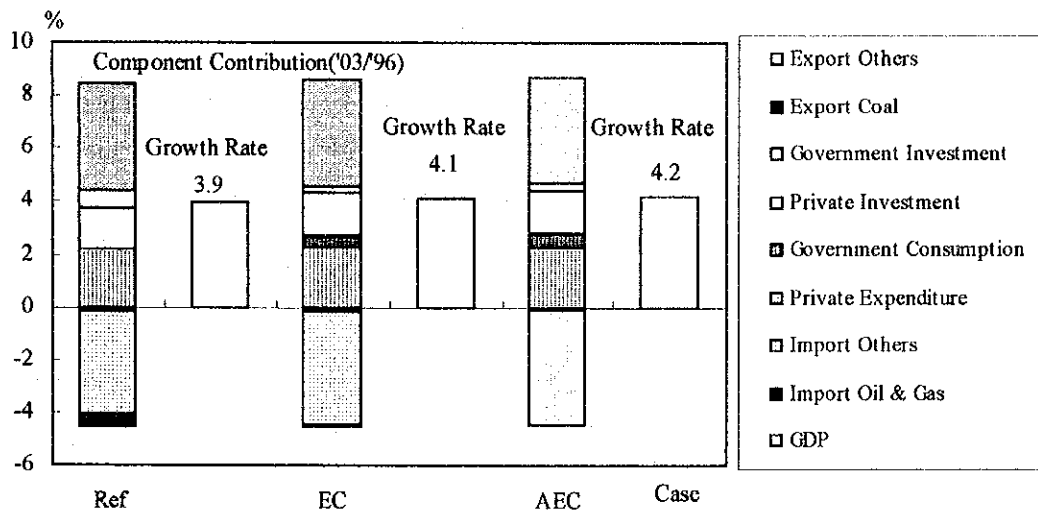
Second, the energy price rise improves the productivity of the energy industry and expands profit and value added. Consequently, it allows the government to increase its expenditure, and then it pushes up GDP growth.

**Table 9.10 Simulation Results for the Energy Conservation Scenarios**

(Unit: 1990 Price Billion PLN, %)

Variable	Mean	Actual		Reference				EC				AEC						
		1996	96/90	2000	00/96	2003	03/00	03/96	2000	00/96	2003	03/00	03/96	2000	00/96	2003	03/00	03/96
CP	Private Expenditure	37.0	5.5	43.1	3.9	48.4	3.9	3.9	43.3	4.0	48.8	4.1	4.0	43.3	4.0	48.9	4.1	4.1
CG	Government Consumption	14.5	5.0	13.8	-1.2	13.5	-0.7	-1.0	15.8	2.2	16.8	2.0	2.1	16.1	2.8	17.2	2.2	2.5
J	Investment Total (IP + IG)	19.0	4.8	24.1	6.1	30.6	8.2	7.0	23.3	5.2	28.9	7.5	6.2	23.3	5.2	28.9	7.5	6.2
IP	Private Investment	9.6	3.5	13.2	8.3	17.8	10.6	9.3	13.4	8.7	18.2	10.8	9.6	13.4	8.8	18.3	10.9	9.7
IG	Government Investment	9.4	6.2	11.0	3.8	12.8	5.2	4.4	9.9	1.2	10.7	2.7	1.8	9.9	1.2	10.7	2.5	1.8
J	Stock Change	0.4	-27.0	0.4	-2.4	0.4	2.0	-0.5	0.4	-2.4	0.4	2.0	-0.5	0.4	-2.4	0.4	2.0	-0.5
E	Export Total(EXCL+EXOT)	26.5	8.7	36.5	8.3	46.6	8.5	8.4	36.8	8.5	47.2	8.7	8.6	36.9	8.6	47.4	8.7	8.7
EXCL	Export Coal	1.1	2.6	0.2	-30.7	0.0	-100.0	-100.0	0.7	-8.8	0.8	0.6	-4.9	0.9	-5.4	0.9	2.4	-2.2
EXOT	Export Others	25.4	9.0	36.2	9.2	46.6	8.8	9.0	36.0	9.1	46.4	8.8	9.0	36.1	9.1	46.5	8.8	9.0
M	Import Total(MOG+MOT)	30.8	16.9	40.0	6.8	52.2	9.2	7.8	41.1	7.5	54.0	9.5	8.4	41.1	7.5	54.1	9.6	8.4
MOG	Import Oil & Gas	1.3	0.5	1.8	8.5	2.2	6.2	7.5	1.7	7.1	2.1	5.8	6.5	1.7	6.8	2.0	5.6	6.3
MOT	Import Others	29.4	18.2	38.2	6.7	50.0	9.4	7.9	39.3	7.5	51.9	9.7	8.5	39.4	7.5	52.0	9.8	8.5
SD	Statistical Difference	-0.4	-27.0	-0.4	0.0	-0.4	0.0	0.0	-0.4	0.0	0.0	0.0	0.0	-0.4	0.0	-0.4	0.0	0.0
GDP	Gross Domestic Expenditure	66.3	2.8	77.5	4.0	86.9	3.9	3.9	78.0	4.1	87.7	4.0	4.1	78.6	4.3	88.4	4.0	4.2
WPI	Wholesale Price Index	475	29.7	678	9.3	695	0.9	5.6	751	12.1	827	3.3	8.2	751	12.1	831	3.5	8.3
CPI	Consumer Price Index	660	36.9	972	10.2	1,101	4.2	7.6	1,116	14.0	1,370	7.1	11.0	1,113	14.0	1,376	7.3	11.1
WI	Average wage Index	567	33.5	902	12.3	1,049	5.2	9.2	992	15.0	1,237	7.6	11.8	987	14.9	1,235	7.8	11.8

**Figure 9.7 Simulation Results of GDP for the Scenarios**



**2) Prices**

On the other hand, the increase of the energy price in constant price pushes up domestic commodity prices. The annual increasing rates of the wholesale price indices during the period from 1996 to 2003 are 8.2% and 8.3% for the two cases.



These are larger than that of the "Reference" scenario by about 3.6 points. Similarly, the annual increasing rate of consumer price index is higher by around 3.4 points, compared to that of the "Reference" scenario.

### 3) Governmental financial balance

The rise of the energy price expands the income of the government through the expansion of profits and value added in the energy industry, which is accompanied by increase sales revenue and productivity improvements.

The total governmental financial income in 2003 is 282 billion PLN for the "EC" and 290 billion PLN for the "AEC" scenarios, instead of 181 billion PLN for the "Reference" scenario.

The rates that these figures account for in the nominal term GDP in the same year are projected to be 28%, 33% and 33% in order from the "Reference," "EC," and "AEC" scenarios, although it was 27% in 1996. Excluding the additional portion of the value added which is incremented by the energy industry, the rates fall to around 25% in 2003 in every scenario from 27% in 1996.

In the model, we treat the government sector as an economic subject to handle the incremental value added provided by the productivity improvement in the energy industry. However, it is not necessary to determine who is the appropriate actor to manage this amount, because the simulation result does not change. In reality, the profit might be dispersed among various economic actors.

We should recognize that rationalization, which brings the productivity improvement in the energy industry, has a big impact on the growth of GDP.

## b. Energy supply and demand

### 1) Primary energy supply

The annual changing rate of the primary energy supply for the "EC" is -0.9% in the period from 1996 to 2003. It is also -1.5% for the "AEC."

Comparing these figures with that of the "Reference," the former is 2.1 points smaller and the latter is 22.4 points smaller.

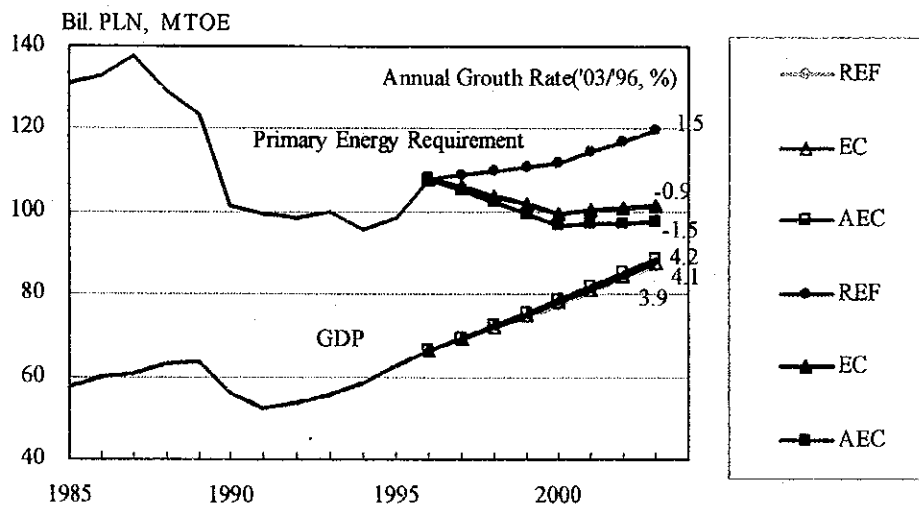
The primary energy supply of each scenario in 2003 is 103.8 MTOE for "EC" and 100.7 MTOE for the "AEC," which correspond to 85% and 83% of the "Reference" scenarios (Figure 9.8)

As a result, the energy/GDP intensity in 2003 for the "EC" is projected to be 1.16 kg/PLN and that of the "AEC" is 1.10 kg/PLN. These are 16% and 20% smaller than the 1.38 kg/PLN for the "Reference" scenario. Because the value in 1996 is 1.63 kg/PLN, the annual declining rate is 2.4% for the "Reference," 4.8% for the "EC," and 5.5% for the "AEC."

The annual improvement ratio of the energy/GDP intensity of the "Reference" almost follows the trend of the past record from 1989 to 1996. Two other scenarios have further accelerated improvement of the energy/GDP intensity.

This improvement is not unrealistic. If we look at the trend from 1987 to 1995, the intensity of that period was ameliorated at the rate of 4.4% per year. Therefore, we should recognize that the two energy-saving scenarios are cases which will realize implementation of energy conservation trends similar to the best records (Figure 9.9).

**Figure 9.8 Simulation Results of Primary Energy Requirement**



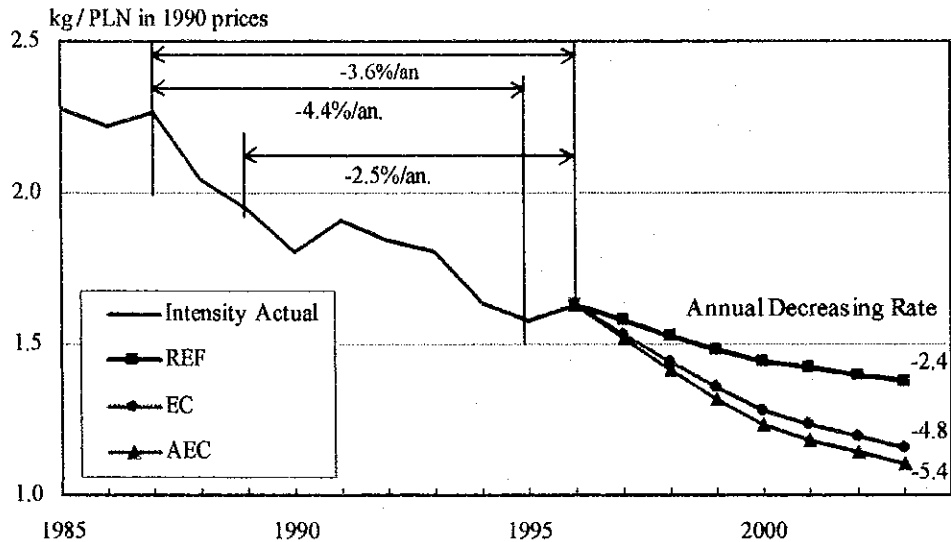


Figure 9.9 Simulation Results of Energy/GDP Intensity

In other words, unless the energy-saving policy is introduced, the improvement effect of energy efficiency experienced in the past cannot be expected, and some approach is necessary if Poland wants to enjoy energy savings it did in the past.

## 2) Final energy consumption

Similar to the primary energy supply, the annual increase rates of the final energy consumption for the two energy conservation scenarios are smaller than that of the "Reference" scenario. For the "EC" its annual growth rate is 2.0 points smaller, and for the "AEC" it is 3.3 points smaller annually.

Energy-saving impact affects on coal are the biggest, followed by gas and electricity. The main reason is that the largest decreases in coal demand result in is a low rate of increase in demand in the industrial sector.

Conversely, the influence on oil is slight due to two reasons. First, we have the assumption that the prices of petroleum products until 2000 will decline in the simulation, and second, fuel demand for the transportation sector is expected to have

stable growth with an expansion of the car population (Table 9.11 and Figure 9.10).

### 3) Energy consumption in the industrial sector

In the two cases considered for energy saving, energy consumption in the industrial sector is projected to decrease tremendously. The annual decrease rate from 1996 to 2003 for the "EC case" is -3.0% and for the "AEC case" is -4.28%. If dividing the former and latter until 2000, the percentage decrease until 2000 is bigger. This is because the value in 1996 was extraordinarily large.

Compared to the "Reference case," the demand in the both cases is restrained by 3.8 points and 5.0 points respectively in terms of the annual growth rate. Within these, 0.2 points is caused by the price raise, and 3.6 points and 1.2 points are estimated to be the effects of the energy-saving induction plan (Figure 9.11).

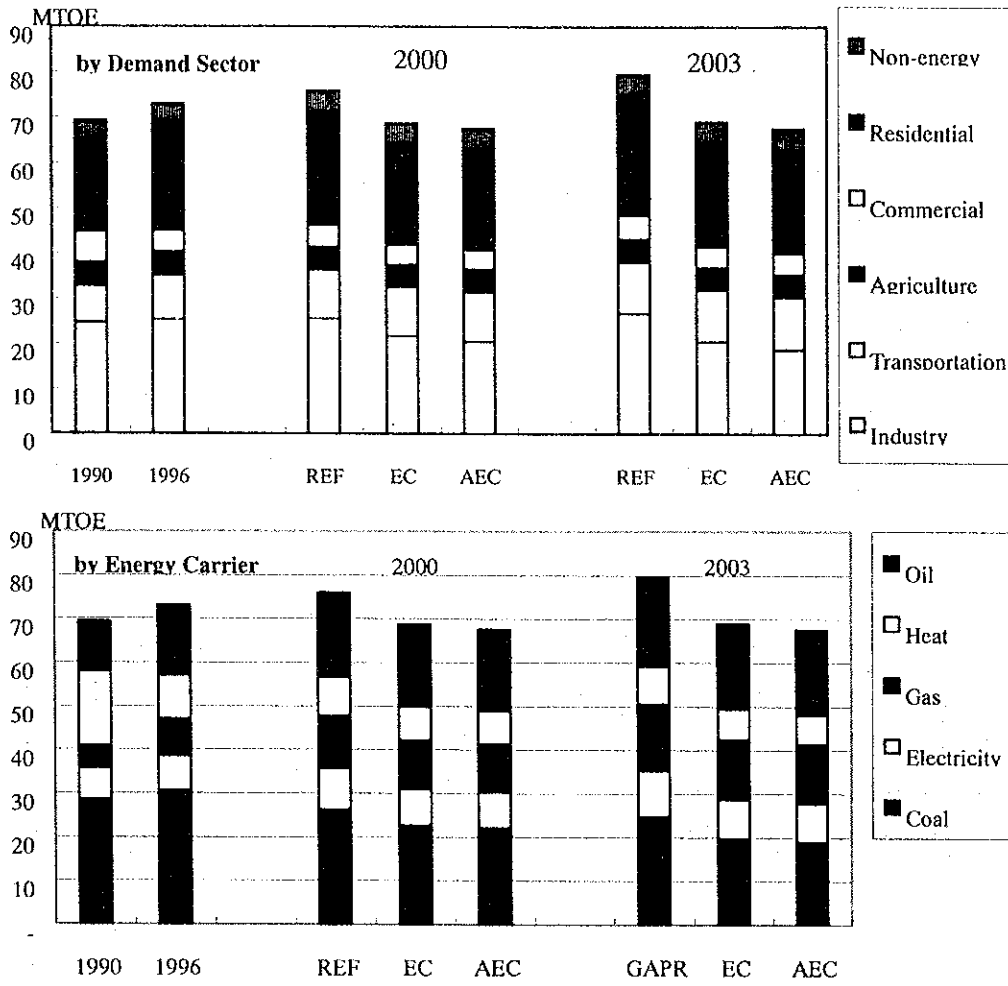
### c. CO<sub>2</sub> emissions

According to the simulation result, CO<sub>2</sub> emissions in 2003 are 118 million ton-C for the "Reference case," 99 million ton-C for the "EC case," and 95 million ton-C for the "AEC case." Comparing these figures with that in 1988, which is 133.2 million tons-C, the figure of the "Reference case" falls behind by 12%, and the values of the two energy conservation cases are estimated to be smaller by 26% and 29% respectively (Figure 9.12).

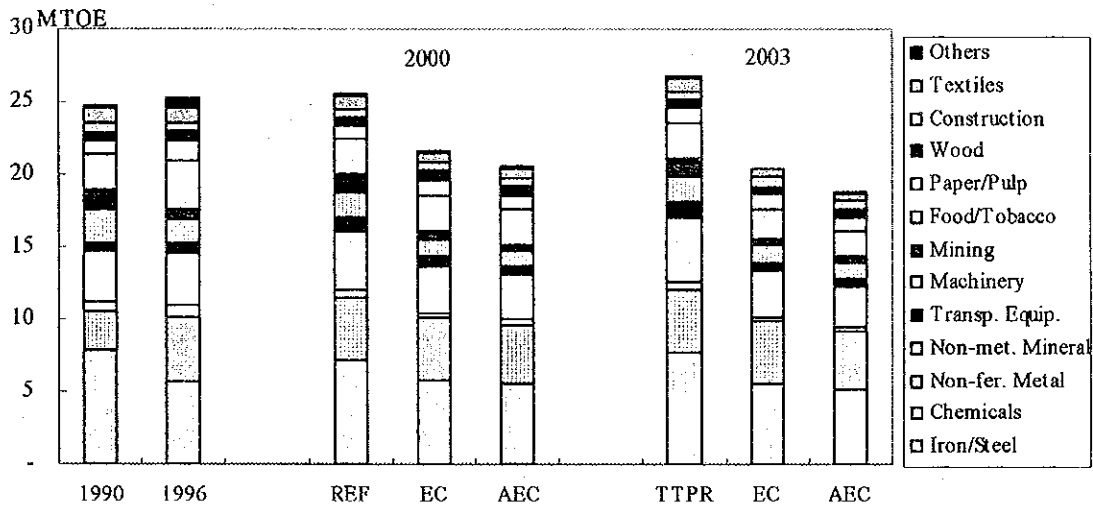
**Table 9.11 Simulation Results of Final Energy Consumption**

Item	(Unit: 1000 TOE, %)																
	Actual		Reference				EC		AEC								
	1995 '95/'90	2000 '96/'00	2003 '03/'00	2003 '03/'00	2003 '03/'96	2000 '96/'00	2003 '03/'00	2003 '03/'00	2003 '03/'96								
<b>by Sector</b>																	
Industrial Sector	25,325	0.4	25,502	0.2	26,728	1.6	0.8	21,641	-3.9	20,457	-1.9	-3.0	20,483	-5.2	18,782	-2.8	-4.2
Transportation Sector	9,920	3.5	10,931	2.5	11,454	1.6	2.1	10,954	2.5	11,574	1.9	2.2	10,976	2.6	11,612	1.9	2.3
Agriculture	5,166	0.2	4,912	-1.3	4,960	0.3	-0.6	4,902	-1.3	4,946	0.3	-0.6	4,906	-1.3	4,950	0.3	-0.6
Commercial	4,654	-6.5	4,956	1.6	5,416	3.0	2.2	4,406	-1.4	4,691	2.1	0.1	4,408	-1.3	4,702	2.2	0.1
Residential	24,062	2.9	24,979	0.9	26,336	1.8	1.3	22,207	-2.0	22,810	0.9	-0.8	22,214	-2.0	22,865	1.0	-0.7
Non-energy Use(Incl. feed stock)	3,882	-1.4	4,616	4.4	4,601	-0.1	2.5	4,579	4.2	4,557	-0.2	2.3	4,603	4.3	4,581	-0.2	2.4
Total	73,009	0.9	75,896	1.0	79,494	1.6	1.2	68,690	-1.5	69,034	0.2	-0.8	67,590	-1.9	67,492	0.0	-1.1
<b>by Energy</b>																	
Coal (incl. Solid Fuel)	30,564	1.2	26,261	-3.7	24,747	-2.0	-3.0	22,645	-7.2	19,587	-4.7	-6.2	22,119	-7.8	18,973	-5.0	-6.6
Electricity	8,035	1.6	9,360	3.9	10,551	4.1	4.0	8,461	1.3	9,103	2.5	1.8	8,261	0.7	8,792	2.1	1.3
Gas	8,454	9.3	12,122	9.4	15,138	7.7	8.7	11,014	6.8	13,736	7.6	7.2	10,869	6.5	13,459	7.4	6.9
Heat	10,028	-8.6	8,999	-2.7	8,720	-1.0	-2.0	7,790	-6.1	6,969	-3.6	-5.1	7,687	-6.4	6,853	-3.8	-5.3
Petroleum	15,928	5.8	19,154	4.7	20,339	2.0	3.6	18,781	4.2	19,640	1.5	3.0	18,653	4.0	19,414	1.3	2.9

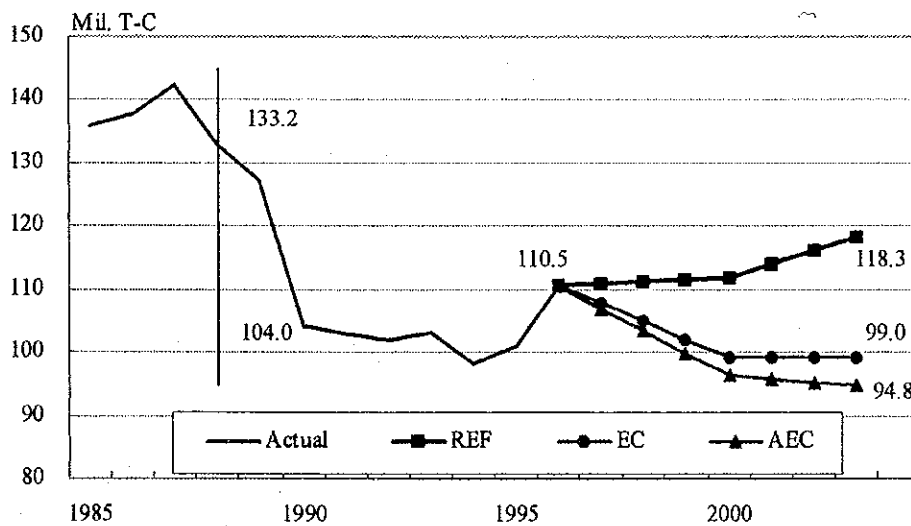
Figure 9.10 Simulation Results of Final Energy Demand



**Figure 9.11 Simulation Results of Energy Demand in the Industrial Sector**



**Figure 9.12 Simulation Results of CO<sub>2</sub> Emissions**





## (2) Influence on the macro-economy

According to the simulation results involving the energy price change, the following characteristics are clearly provided.

First, the energy price rise makes general prices rise. The elasticity with general price to the energy price is about 0.4. In other words, when increasing an energy price by 10%, consumer prices rise by 4.3% and wholesale prices rise by 3.8% (See Table 9.12 and Figure 9.13).

Second, the rise of the energy price reduces the value of a currency, that is, the exchange rate weakens due to the higher energy price. When the energy price rise is zero, the exchange rate in 2003 is 4.1 PLN/US\$, but when we raise the energy price 10% annually, it is projected to be 4.8 PLN/US\$, furthermore, at 20%, it is to be 5.6 PLN/US\$. Hence, the elasticity of the exchange rate to the energy price is estimated to be 0.23.

Third, we should pay attention to the influence of the international current balance. If the currency becomes weak, which means devaluation, the environment for exports improves and that of imports is aggravated. Therefore, the energy price increase makes the international current balance head into the black through the increase of exports and the decrease of imports with a devalued exchange rate. As the energy price rises, the deficit with the international current balance declines as follows: in the case of energy price not changing the current deficit is projected to be 14.5 billion dollars, in case of an energy price increase of 10% it is 9.7 billion dollars, and in the case of 20% it is 4.6 billion dollars, although it is 8.5 billion dollars in 1996.

Fourth, there are the improvement of the current balance of the energy industry and the increase of government expenditure, which accompanies it. If we take the assumption that the increasing rate of supply cost of the energy industry is a half-degree of the rate of increase of the consumer prices index and its expanding profit leads an increase of government expenditure, the impact on financial income is quite big. The elasticity of financial income increases for the energy price rise is approximately 1.0, although there is an influence from the general price rise. In other words, it is expected that the financial income as a nominal base expands as with an energy price rise. Because the elasticity of general prices to the energy price is 0.4, the elasticity of governmental financial income to the energy price in constant prices is 0.6.



Fifth, the change of the macro-economic variables impacts fairly on GDP growth, as shown before. In conclusion, the rise of the energy price accelerates economic growth. The elasticity of GDP growth to energy price is about 0.1. This means that increasing energy price by 10% increases GDP growth rate by about 1%.

The three paths as mentioned before verify that. The first path is as follows: the rise of energy prices → devaluation of the exchange rate → improvement of the balance of payments. The second path is as follows: increase of energy prices → improvement of productivity and current balance of the energy industry → improvement of governmental financial balance → increase of government expenditure. Then, the third path is as follows: rise of energy price → acceleration of the energy conservation → expansion of coal export and reduction of oil and gas imports → improvement of the balance of payments.

**Table 9.12 Energy Price Impacts on Macro-economy**

Item	Unit	Annual Energy Price Change					
		0%	5%	10%	15%	20%	25%
CPI	%('03/'96)	2.2	4.5	6.5	8.8	10.8	12.9
WPI	%('03/'96)	2.1	4.1	6	8.1	9.9	11.8
Exchange Rate	PLN/\$ (2003)	4.1	4.5	4.8	5.2	5.6	6.0
Exchange Rate	%('03/'96)	2.5	3.7	4.8	6.1	7.2	8.3
Current Balance, B.of P.	Bil. US\$(2003)	-14,464	-12,143	-9,650	-7,167	-4,588	-1,850
Government Revenue	%('03/'96)	7.4	12.9	17.9	22.9	27.4	31.5
GDP	%('03/'96)	4.6	5.1	5.7	6.3	6.9	7.4

### (3) Impact on the energy supply and demand

Because the energy price is the main explanatory variable in the demand function with energy, the influence the energy price change exerts on energy supply and demand is much more direct than that on the macro-economy described above.

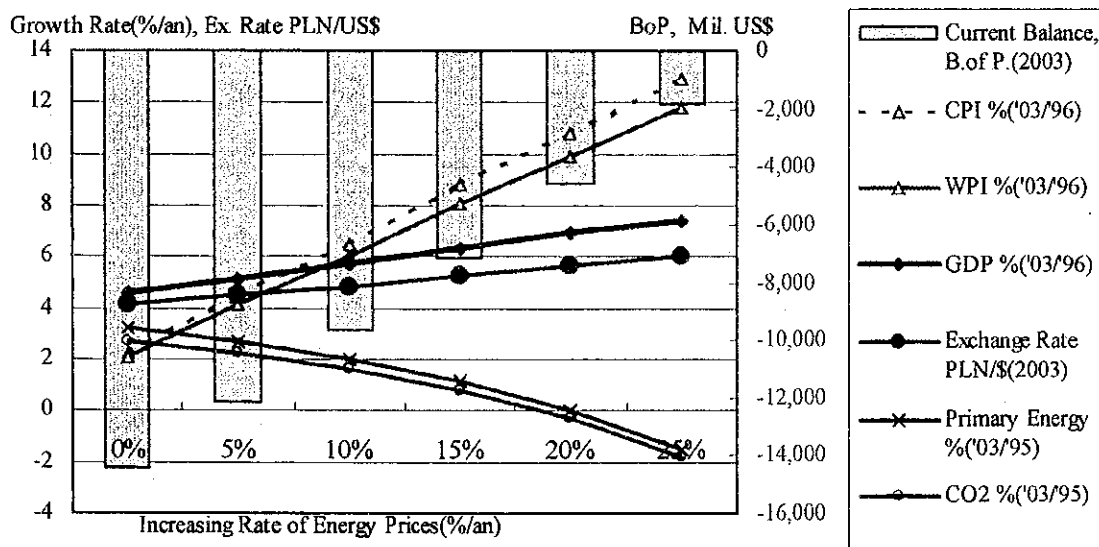
An energy price increase of 10% decreases the primary energy requirement by 1.2% to 2.0% annually. Hence, the elasticity of the primary energy requirement to the energy price is around -0.1 to -0.2.

In addition, if we try to make CO<sub>2</sub> emissions negative growth, we have to set the energy price rise at 20% annually on a nominal basis. The elasticity of CO<sub>2</sub> emissions to energy price is -1.1 to -1.9 (Table 9.13).

**Table 9.13 Energy Price Impacts on Energy Demand**

Item	Unit	Annual Energy Price Change					
		0%	5%	10%	15%	20%	25%
Primary Energy	%('03/'95)	3.2	2.7	2.0	1.2	0.0	-1.5
Final Energy	%('03/'95)	2.6	2.0	1.2	0.2	-1.1	-3.0
Industry	%('03/'95)	2.5	2.1	1.6	1.0	0.1	-1.1
Transportation	%('03/'95)	2.5	2.1	1.5	0.8	-0.1	-1.3
Others(R&C, Ag.)	%('03/'95)	2.4	1.6	0.5	-0.7	-2.5	-5.0
CO <sub>2</sub>	%('03/'95)	2.7	2.2	1.6	0.8	-0.3	-1.8

**Figure 9.13 Energy Price Impact on the Macro-economy**



(4) Measurement of price elasticity by macro-base formula

The sensitivity of demand to the energy price obtained by the above simulations is measured in the whole estimation formula group of the whole model. It contains the

changes of the macro-economic variables due to the energy price change, too.

There is an another simpler way to know the price elasticity of energy demand. That is, we estimate the demand function for energy using the following formula as a prototype.

$$\text{Log}(E) = a \text{Log}(P) + b \text{Log}(Y) + c \text{Log}(E_{t-1}) + d$$

Here,  $E$  is energy demand,  $P$  is energy price, and  $Y$  is income. Therefore, the parameter "a/(1-c)" shows the long-term price elasticity and "b/(1-c)" means long-term income elasticity. Each parameter, which is estimated for every demand sector with energy, is shown in the following table.

According to this table, the price elasticity of the energy demand is quite small, from -0.01 to -0.05 (Table 9.14).

**Table 9.14 Demand Elasticity to Price and Income**

	Price		Income		Lag c	AR <sup>2</sup>	SD	DW	estimation period
	a: Short	Long	b: Short	Long					
Industry	-0.054 (-4.92)	-0.067	0.335 (1.63)	0.417	0.196 (1.42)	0.97	0	2.54	1985-1995
Transportation	-0.009 (-0.06)	-0.012	0.615 (2.2)	0.846	0.274 (0.95)	0.5	0	2.2	1985-1995
Other	-0.032 (-3.12)	-0.036	0.033 (0.08)	0.037	0.115 (0.40)	0.63	0.1	2.05	1985-1995
Primary Energy	-0.047 (-7.09)	-0.049	0.128 (0.86)	0.133	0.043 (0.32)	0.97	0	2.41	1985-1995

(note) Estimation formula is  $\ln(E_t) = a \ln(P_t) + b \ln(Y_t) + c \ln(E_{t-1})$

$E_t$  is the energy demand in  $t$  period,  $P_t$  is the coal price/WPI in  $t$  period.

Here,  $a$  is price elasticity in short term,  $b$  is income elasticity in short term.

Long-term elasticity is calculated by  $a/(1-c)$  and  $b/(1-c)$ .

Figures in ( ) are  $t$  values.

### **9.3 Policy implication**

#### **9.3.1 Energy pricing policy**

It is clear that the adoption of the energy conservation policy brings a positive effect to the GDP growth, based on the simulation result. This is led by the following two paths: (1) "increase energy price → increased revenue and improved of productivity in the energy industry → increased profit or value added of the energy industry," and (2) "energy-saving promotion → decreased energy imports such as petroleum and gas → increased coal exports."

On the other hand, there is a path which has a negative effect on GDP, that is, "increase energy price → acceleration of inflation → decline of purchasing power."

It is common to use an energy pricing policy to promote energy saving. However, when the policy authority uses the pricing policy, it must pay attention to movements of commodity prices and watch the results carefully, because there is an effect of accelerating inflation at the same time.

Needless to say that employment and economic growth are the major goals of the macro-economic policy of the government. At the same time, price stability is also an important policy issue. The rise of the energy price has an unfavorable effect of general prices, although it has desirable effects on economic growth, energy saving, and environmental protection.

Hence, the policy authority has no choice but to execute a policy mixture, considering both positive and negative aspects of pricing policy.

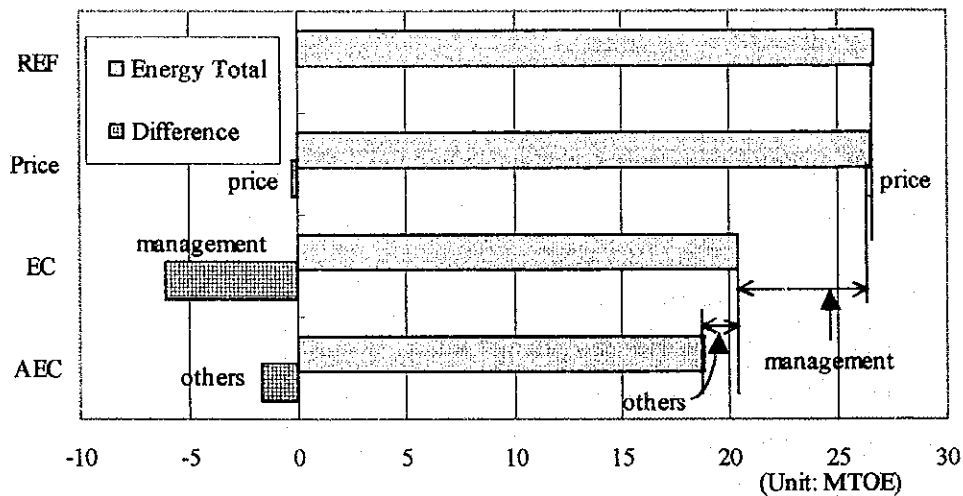
#### **9.3.2 Energy conservation inducement**

The effects of policy measures for energy conservation other than energy pricing are expected to be larger than pricing. The results of comparing the effects are shown in Figure 9.14. The policy measures for energy saving include reinforcement of energy management and economic incentives.

It is the most desirable way is for energy saving to be promoted without exerting a

negative influence on the macro-economy. More concretely, an improvement in the management of operations and maintenance of factories is such measures. However, it is a big problem to motivate managers and employees. Therefore, institutional arrangements for enhancing their motivation are required.

**Figure 9.14 Composition of Factors for Demand Changes in the Industrial Sector**



### 9.3.3 Rationalization of the energy industry and improving productivity improvement

We consider that the government will further accelerate improvement of management efficiency in the energy industry, which was (and partly is) depending on subsidies. As shown in this simulation, expansions of value added and growth of GDP can be expected, if the energy industry restrains its supply cost and improves productivity.

The energy price increase is just an incentive to promote the improvement of productivity. The effect expected from privatization is similar.

Under the model, we treat the government as an economic subject related to incremental profit and value added, but in real economic activity, we do not mind who takes this stake. For instance, assuming privatization, it is possible to think that expansion of profit belongs to the energy industry directly and that it is used for capital investment. Also, we can think that the profit should be returned to the consumer to expand disposal income.

In any case, the important thing is that the improvement of productivity of the energy industry with a rise of energy price is related to expanding value added and GDP.

Therefore, it is an important energy policy to reduce the subsidy of the government to the energy industry and to realize independent development of the energy industry and its productivity improvement.

#### **9.3.4 Energy conservation and CO<sub>2</sub> emission**

The energy conservation policy has a big effect on reducing CO<sub>2</sub> emissions. The reduction of the greenhouse gases, such as CO<sub>2</sub>, is a controversial worldwide issue and Poland is also involved it.

To do its international duty, it is expected that the Polish government will implement an energy conservation policy to mitigate CO<sub>2</sub> emissions.

## Appendix 9-1

### List of the Equations for the MEMP: Macro-economic and Energy Supply/Demand

#### Model for Poland

#### 1 Macro-economic Sector

##### 1.1 GDP in Constant Price

###### 1.1.1 Private Consumption

$$CP=17026.8+21.8624*((GDE.N-GRTAX)/CPI)+1512.42*(DUMTRANS)$$

(4.46) (2.10) (14.09)

OLS (1990-1996) AR2: .974 SD: 555.2171 DW: 2.734

###### 1.1.2 Government Consumption

$$CG=CG.N/PCG*100$$

###### 1.1.3 Private Investment

$$LOG(IP)=-6.77535-.325196*(LOG(INT/(WPI/WPI(-1))))+1.60545*(LOG(CP))+.227776*(DUM91)$$

(-4.56) (-15.81) (11.17) (4.76)

OLS (1988-1996) AR2: .98 SD: 036727 DW: 1.688

###### 1.1.4 Government Investment

$$IG=IG.N/PIG*100$$

###### 1.1.5 Investment Total

$$I=IP+IG$$

###### 1.1.6 Export, Coal

$$LOG(EXCL)=-3.85149+1.08302*LOG((-CLEX))$$

(-3.37) (9.29)

OLS (1988-1995) AR2: .924 SD: .053337 DW: 1.16

###### 1.1.7 Export, Others

$$EXOT=-22166.4-8340.30*(PEXOT/(PEW*EXR2))+11.7765*(TWM)+1.12595*(IP)$$

(-6.42) (-1.00) (7.46) (2.60)

OLS (1990-1996) AR2: .967 SD: 731.6146 DW: 2.716

###### 1.1.8 Export, Total

$$EX=EXCL+EXOT$$

###### 1.1.9 Import, Oil & Gas

$$MOG=4.21499+.056412*((CRIM+PTIM+GAIM))+78.0672*(DUM95)$$

(1.57) (461.39) (111.92)

OLS (1986-1995) AR2: 1. SD: .659397 DW: 1.785

###### 1.1.10 Import, Others

$$MOT=7871.19+.538981*((CP+I))-21260.8*(PM/CPI)-4865.70*(DUM89)$$

(1.63) (5.60) (-9.35) (-2.69)

OLS (1987-1996) AR2: .935 SD: 1,574.35 DW: .951

###### 1.1.11 Import, Total

$$M=MOG+MOT$$

###### 1.1.12 GDP, GDE(Gross Domestic Expenditure)

$$GDE=CP+CG+I+J+EX-M$$

## 1.2 GDP in Current Price

### 1.2.1 Private Consumption

$$CP.N = CP * PC / 100$$

### 1.2.2 Government Consumption

$$CG.N = 7823.96 + 506303 * (GPCE)$$

(3.90) (17.00)

$$OLS \quad (1991-1996) \quad AR2: .983 \quad SD: 2,039.56 \quad DW: 2.127$$

### 1.2.3 Private Investment

$$IP.N = IP * PIP / 100$$

### 1.2.4 Government Investment

$$IG.N = -9062.27 + 9.81363 * (GPDE) + 12466.9 * (DUM96)$$

(-1.57) (4.21) (2.24)

$$OLS \quad (1990-1996) \quad AR2: .932 \quad SD: 3,410.01 \quad DW: 1.962$$

### 1.2.5 Investment, Total

$$I.N = IP.N + IG.N$$

### 1.2.6 Stock Change

$$J.N = J * PJ / 100$$

### 1.2.7 Export, Coal

$$EXCL.N = EXCL * PEXCL / 100$$

### 1.2.8 Export, Others

$$EXOT.N = EXOT * PEXOT / 100$$

### 1.2.9 Export, Total

$$EX.N = EXCL.N + EXOT.N$$

### 1.2.10 Statistical Difference

$$SD.N = SD * PSD / 100$$

### 1.2.11 Import, Oil & Gas

$$MOG.N = MOG * PMOG / 100$$

### 1.2.12 Import, Others

$$MOT.N = MOT * PMOT / 100$$

### 1.2.13 Import Total

$$M.N = MOG.N + MOT.N$$

### 1.2.14 GDP, GDE

$$GDE.N = CP.N + CG.N + I.N + J.N + EX.N - M.N + SD.N$$

## 1.3 Prices

### 1.3.1 WPI(Wholesalers Price Index)

$$WPI/WPI(-1) = -.440295 + 438671 * (PM/PM(-1)) + 2.33713 * (MLM2/GDE.N)$$

(-5.09) (4.30) (6.48)

$$+ 239711 * (PELEH/PELEH(-1))$$

(4.89)

$$OLS \quad (1988-1996) \quad AR2: .999 \quad SD: 047458 \quad DW: 2.224$$

### 1.3.2 CPI(Consumers Price Index)

$$CPI/CPI(-1) = -.031281 + 378272 * (WPI/WPI(-1)) + 554919 * (WI/WI(-1))$$

(-1.09) (3.14) (6.39)

$$+ 110649 * (PELEH/PELEH(-1))$$



(3.29)

OLS (1989-1996) AR2: 1. SD: .036437 DW: 1.823

1.3.3 Wage Index

WI/WI(-1)= .803474+.723659\*(PC/PC(-1))- .439421\*((GDE/L)/(GDE(-1)/L(-1)))

(2.78) (9.69) (-2.11)

OLS (1988-1996) AR2: .974 SD: .200171 DW: 3.192

1.3.4 Price Deflator for 'CP'

PC=1.16223+.937172\*(CPI)+.037167\*(PC(-1))

(.67) (23.84) (0.76)

OLS (1986-1996) AR2: 1. SD: 3.47177 DW: 1.242

1.3.5 Price Deflator for 'CG'

PCG=40.2423+.594312\*(CPI)+32.9446\*(DUM9192)

(4.23) (28.74) (3.79)

OLS (1990-1996) AR2: .994 SD: 9.00341 DW: 2.754

1.3.6 Price Deflator for 'IP'

PIP=53.6488+.377212\*(WPI)+.164677\*(WPI(-1))

(2.99) (1.56) (0.68)

OLS (1990-1996) AR2: .982 SD: 10.3051 DW: 3.393

1.3.7 Price Deflator for 'IG'

PIG=20.7811+.954265\*(WPI)-87.0042\*(DUM95)+35.4356\*(DUM92)

(1.51) (20.51) (-5.12) (2.28)

OLS (1990-1996) AR2: .987 SD: 13.9458 DW: 2.52

1.3.8 Price Deflator for 'I'

PI=I.N/I\*100

1.3.9 Price Deflator for 'J'

PJ=45.9950+.225395\*(CPI)+964.217\*(DUM9596)

(1.31) (1.54) (12.37)

OLS (1988-1996) AR2: .984 SD: 58.9407 DW: 1.558

1.3.10 Price Deflator for 'SD:::'

PSD= 41.2728+.221032\*(CPI)+895.909\*(DUM9596)+151.688\*(DUM96)

(1.85) (2.21) (14.85) (2.46)

OLS (1987-1996) AR2: .991 SD: 43.0688 DW: .816

1.3.11 Price Deflator for 'EXCL'

PEXCL=.003593+3.04904\*(PEXCLD\*EXR1)

(.16) (9206.94)

OLS (1988-1996) AR2: 1. SD: .033748 DW: .802

1.3.12 Price Deflator for 'EXOT'

PEXOT=5.14912+.443794\*(WPI)+31.3944\*(EXR1)

(1.30) (5.69) (3.14)

OLS (1986-1996) AR2: .995 SD: 8.11802 DW: 1.8

1.3.13 Price Deflator for 'EX'

PEX=EX.N/EX\*100

1.3.14 Price Deflator for 'MOG'

PMOG=-12.9963+7.73488\*(POILUS\*EXR2)+119.711\*(DUM96)

(-.73) (13.73) (3.22)

OLS (1987-1996) AR2: .97 SD: 31.6849 DW: 2.077

1.3.15 Price Deflator for 'MOT'

PMOT=-.894304+.239533\*(PEW\*EXR2)+.784122\*(PMOT(-1))+55.4292\*(DUM90)

(.22) (3.67) (7.77) (5.75)

OLS (1987-1996) AR2: .996 SD: 6.79616 DW: 1.597

1.3.16 Price Deflator for 'M'

PM=M.N/M\*100

1.3.17 Price Deflator for 'GDP'

P=GDE.N/GDE\*100

## 1.4 Labor

1.4.1 Unemployment Ratio

URATE= 40.5463+2.84373\*((WI/(GDE/LN))/(WI(-1)/(GDE(-1)/LN(-1))))-35.3466\*((L/L(-1))  
(3.16) (1.12) (-2.81)  
+595290\*(URATE(-1))-524035\*(DUMTRANS)  
(3.82) (-2.05)

OLS (1991-1996) AR2: .892 SD: .567388 DW: 3.041

1.4.2 Active Population

LA=-1308.04+.030405\*(POP)+1.01265\*(LA(-1))-54.4299\*(DUM8991)  
(-1.82) (0.70) (21.75) (-3.95)

OLS (1986-1996) AR2: .999 SD: 13.5391 DW: 1.84

1.4.3 Number of Workers(willing to work)

L/LA= 2.77399-3.39697\*((LA/POP))+.021742\*(DUM92)  
(5.62) (-4.01) (1.90)

OLS (1990-1996) AR2: .804 SD: .010120 DW: 1.947

1.4.4 Number of Unemployment

U=L\*URATE/100

1.4.5 Number of Employment

LN=L-LOT-U

## 1.5 Government Financial Balance and Others

1.5.1 Tax Revenue

GRTAX=1172.14+.402258\*(CP.N)+.517061\*((EX.N-M.N))  
(.76) (30.70) (3.12)

OLS (1990-1996) AR2: .996 SD: 1,698.95 DW: 1.527

1.5.2 Other Revenue

GROTR=2186.63+.027340\*(CP.N)+1804.03\*(DUM95)  
(6.50) (10.05) (3.29)

OLS (1990-1996) AR2: .964 SD: 466.1768 DW: 2.506

1.5.3 Additional Revenue due to Higher Energy Prices

ADDGR=RINCLENE

1.5.4 Revenue Total

GRT=GRTAX+GROTR + ADDGR

1.5.5 Current Expenditure

GPCE=GRT-GPDE

1.5.6 Financial Expenditure Total

GPT=GPCE+GPDE

1.5.7 Government Financial Balance

GRPD=GRT-GPT = 0

### 1.5.8 Money Supply

MLM2=4419.20+3.365218\*(GDE.N)-117.919\*(INT)

(2.32) (63.29) (-2.92)

OLS (1988-1996) AR2: .998 SD: 1,966.44 DW: 2.535

### 1.5.9 Exchange Rate for Export

EXR1=-1.91610+3.33206\*((P(-1)/PM(-1)))-.0000138\*(DBLCR)

(-10.27) (22.26) (-1.25)

OLS (1991-1996) AR2: .994 SD: .058232 DW: 3.478

### 1.5.10 Exchange Rate for Import

EXR2=.291312+.823594\*(EXR1)-.302364\*(DUM93)

(3.17) (20.23) (-3.51)

OLS (1990-1995) AR2: .988 SD: .076041 DW: 2.651

## 1.6 Balance of Payment

### 1.6.1 Export, Coal

DEXCL=-.158998+1.00026\*(EXCL.N/EXR1)

(-.16) (842.17)

OLS (1990-1996) AR2: 1. SD: .356904 DW: 1.43

### 1.6.2 Export, Others

DEXOTR=-8.63979+1.00049\*(EXOT.N/EXR1)

(-9.48) (18666.73)

OLS (1990-1996) AR2: 1. SD: .591192 DW: 2.455

### 1.6.3 Export, Total

DEX=DEXCL+DEXOTR

### 1.6.4 Import, Oil & Gas

DMOG=-.586313+1.00032\*(MOG.N/EXR2)

(-.77) (2197.72)

OLS (1990-1996) AR2: 1. SD: .367291 DW: 1.825

### 1.6.5 Import, Others

DMOTR=-.877158+1.00009\*(MOT.N/EXR2)

(-.49) (10072.13)

OLS (1990-1996) AR2: 1. SD: 1.77497 DW: 2.831

### 1.6.6 Import, Total

DM=DMOG+DMOTR

### 1.6.7 Balance of Trade

DBLTR=DEX-DM

### 1.6.8 Current Balance

DBLCR=DBLTR+DSERV+DTRANS

## 1.7 Industrial Activity(production in physical term)

### 1.7.1 Steel

STEEL=- 107,995.1+13,329.1\*LOG(GDE)-3,163.80\*LOG(MOT)-534.4371\*DUM93

(-6.62) (8.61) (-7.25) (-1.78)

OLS( 1989 - 1995 ) AR2: 0.9516 SD: 267.420 DW: 2.300

1.7.2 Paper

PAPERP = -19,533.7 +1,929.90\*LOG(GDE) +178.9775\*DUM90 +64.1731\*DUM95  
(-12.09) (13.11) (5.87) (2.05)  
+48.4512\*DUM93  
(1.57)  
OLS (1986 - 1995) AR2: 0.9611 SD: 27.858 DW: 2.120

1.7.3 Sugar

SUGAR = 1,785.2 -0.00842\*MOT -193.0723\*DUM92 +338.5658\*DUM93 -243.2172 DUM94  
(39.20) (-2.96) (-6.40) (11.13) (-7.66)  
+276.4625\*DUM90  
(8.44)  
OLS (1988 - 1995) AR2: 0.9841 SD: 26.924 DW: 2.127

1.7.4 Meat

MEAT = 16,557.6 +0.0953\*CP -1,879.24\*LOG(MOT) -137.17\*DUM93 +273.51\*DUM95  
(11.72) (7.07) (-13.27) (-1.41) (2.10)  
OLS (1986 - 1995) AR2: 0.9732 SD: 82.575 DW: 2.902

1.7.5 Fertilizer

FERTIL = -4,002.93 +6.52567\*IP +1.58093\*CP +409.7585\*DUM92  
(-3.04) (11.03) (3.34) (1.32)  
OLS (1988 - 1995) AR2: 0.9727 SD: 261.531 DW: 2.816

1.7.6 Chemical Products

CHEMP = -89,956.1 +737.9016\*LOG(IP) +11,789.1\*LOG(CP) -2,590.80\*LOG(MOT)  
(-6.84) (1.35) (5.75) (-4.30)  
-849.1799\*DUM91  
(-4.02)  
OLS (1989 - 1995) AR2: 0.9724 SD: 178.547 DW: 2.686

1.7.7 Vehicle

VEHICLE = 86.01 -0.01225\*IP +0.01037\*CP -141.65\*DUM91 -103.75\*DUM92 +27.4224\*DUM95  
(8.05) (-28.16) (27.68) (-63.81) (-45.93) (12.60)  
OLS (1988 - 1995) AR2: 0.9993 SD: 1.754 DW: 2.619

1.7.8 Cement

CEMENT = -201,839.0 +22,885.2\*LOG(GDE) -3,671.38\*LOG(MOT) -1,792.82\*DUM90  
(-9.89) (13.22) (-7.69) (-4.46)  
+616.1348\*DUM94  
(1.53)  
OLS (1986 - 1995) AR2: 0.9720 SD: 351.266 DW: 1.648

1.7.9 Aluminum Production

ALUM = -126.7780 +15.8397\*LOG(GDE) +7.5550\*DUM95  
(-1.89) (2.59) (5.55)  
OLS (1985 - 1995) AR2: 0.8383 SD: 1.218 DW: 2.064

1.7.10 Lead

LEAD = -1,163.78 +125.5194\*LOG(GDE) -15.5138\*LOG(MOT) +5.80937\*DUM93  
(-91.51) (103.98) (-45.60) (24.87)  
OLS (1989 - 1995) AR2: 0.9995 SD: 0.208 DW: 2.402

1.7.11 Zinc

ZINC = -407.2373 +63.7270\*LOG(IP) -35.4905\*DUM8991  
(-8.36) (11.71) (-9.01)  
OLS (1986 - 1995) AR2: 0.9578 SD: 4.126 DW: 1.815

1.7.12 Board

WBOARD = -54,863.3 +8,207.27\*LOG(GDE) -3,225.55\*LOG(MOT) -930.4394\*DUM90

(-4.25) (7.43) (-11.45) (-3.62)  
OLS(1986 - 1995) AR2:0.9621 SD:224.402 DW:1.875

#### 1.7.13 Machinery Tool

MATLT = 8.39612 + .004329\*IP -.001434\*MOT + 5.16355\*DUM9091  
(1.15) (8.57) (-5.39) (2.23)  
OLS(1988 - 1995) AR2:0.9686 SD:2.333 DW:2.437

#### 1.7.14 Cotton

COTTON = -26,675.3 + 2,693.13\*LOG(CP) -.049775\*MOT - 113.3804\*DUM93  
(-9.19) (9.49) (-13.08) (-2.20)  
+172.8124\*DUM90 - 84.6099\*DUM94  
(2.65) (-1.66)  
OLS(1988 - 1996) AR2:0.9595 SD:46.895 DW:2.885

#### 1.7.15 Wool

WOOL = -1,094.47 + 204.1124\*LOG(CP) - 99.5437\*LOG(MOT) - 16.0113\*DUM9293  
(-6.63) (15.51) (-12.31) (-4.82)  
-11.2013\*DUM94 + 6.55349\*DUM95  
(-2.23) (0.10)  
OLS(1986 - 1996) AR2:0.9939 SD:2.557 DW:1.692

#### 1.7.16 Ship, Launched DWT

SHIPLT = 360.8537 + .012687\*GDE - 691.0633\*WI/CPI - 153.6137\*DUM90 - 35.7384\*DUM91  
(1.27) (2.35) (-10.37) (-3.62) (-0.67)  
+121.8893\*DUM93  
(2.82)  
OLS(1986 - 1995) AR2:0.9568 SD:35.812 DW:1.323

## 2 Energy Supply/Demand Sector

### 2.1 Final Energy Consumption in the Industrial Sector

#### 2.1.1 Iron/Steel

TIIR = 1873.33 - 3921.82\*(PCLIN/WPI) + .725571\*(STEEL) + 555.798\*(DUM91)  
(2.49) (-4.70) (9.47) (3.99)  
OLS(1988-1995) AR2:.994 SD:122.2726 DW:2.458

#### 2.1.2 Chemical

TTCH = 4641.67 - 7029.29\*(PEXCLZ/WPI) + .065538\*(CHEMP) - 699.631\*(DUM92)  
(5.04) (-6.44) (1.15) (-3.82)  
-389.950\*(DUM90)  
(-2.18)  
OLS(1988-1995) AR2:.919 SD:159.1752 DW:3.114

#### 2.1.3 Non-ferrous Metal

TTNF = 162.5710 - 838,097.9\*(PELEH/PI) + 2.12746\*(ALUM+LEAD+ZINC)  
(1.32) (-9.54) (5.20)  
+141.6353\*DUM91 + 319.3357\*DUM94 + 333.3451\*DUM95  
(4.91) (10.23) (8.84)  
OLS(1988-1995) AR2:.982 SD:21.837 DW:3.133

#### 2.1.4 Non-mineral Mining

TTMN = 1,165.81 - 1,062.45\*PCLIN/WPI + .004149\*CLPD - 486.4384\*DUM94  
(4.60) (-5.07) (1.90) (-13.43)  
-414.5479\*DUM95 - 243.0051\*DUM93

(-11.30) (-7.24)  
OLS (1988-1995) AR2: 0.9935 SD: 28.269 DW: 3.147

2.1.5 *Transportation Equipment*

TTTE/SHIPLT = -.223336 -.654475\*LOG(PCLIN/WPI) +.452118\*TTTE(-1)/SHIPLT(-1)  
(-.79) (-8.77) (4.31)  
OLS (1989-1995) AR2: 0.9264 SD: .0233 DW: 2.641

2.1.6 *Machinery*

TTMA=1726.46-1992.13\*(PCLIN/WPI)+45.4093\*(MATLT)-736.303\*(DUM90)-94.5073\*(DUM95)  
(1.76) (-0.83) (1.79) (-2.56) (-0.34)  
OLS (1988-1995) AR2: .913 SD: 248.0342 DW: 2.525

2.1.7 *Mining and Quarrying*

TTMN=2135.89-3130.30\*(PCLIN/WPI)-.004638\*(CLPR)+385.294\*(DUM9192)-86.1865\*(DUM94)  
(8.23) (-12.45) (-1.74) (10.88) (-2.13)  
OLS (1988-1995) AR2: .992 SD: 31.3052 DW: 2.983

2.1.8 *Food*

TTFO=2359.22-434.395\*(PCLIN/WPI)+.072475\*(MEAT+SUGAR)+259.550\*(DUM95)  
(2.98) (-0.56) (0.35) (2.77)  
-211.242\*(DUM90)-271.681\*(DUM92)  
(-2.30) (-2.90)  
OLS (1988-1995) AR2: .806 SD: 79.2343 DW: 2.215

2.1.9 *Paper and Pulp*

TTPA = 918.4162 -29.6513\*LOG(PCLIN/PC) +.009739\*(PAPERP+PAPERP(-1))  
(4.33) (-3.39) (0.14)  
+236.1330\*DUM95  
(5.39)  
OLS (1988-1995) AR2: .08744 SD: .34.095 DW: 2.978

2.1.10 *Wood and Wood Products*

TTWO=-128.026-57.7728\*((PCLIN/PI))+.035076\*(WBOARD)+.006859\*(CP)  
(19.63) (-5.18) (14.13) (24.58)  
-6.79840\*(DUM94)+48.7015\*(DUM95)  
(-7.15) (45.74)  
OLS (1989-1995) AR2: 1. SD: 640269 DW: 3.139

2.1.11 *Construction*

TTCN = -368.6510 -115.6041\*LOG(PCLIN/PC) +79.4380\*LOG(IP) -202.7987\*DUM95  
(-.49) (-8.88) (0.89) (-5.39)  
-110.8761\* DUM94 +152.5369\*DUM9091  
(-3.93) (6.93)  
OLS (1988-1995) AR2: .995 SD: 20.202 DW: 2.841

2.1.12 *Textile*

LOG(TTTX) = 6.38668 +.065647\*LOG(COTTON+WOOL)-.064756\*LOG(PCLIN/WPI)  
(19.50) (1.08) (-4.13)  
-.239450\*DUM94 -.119006\*DUM92  
(-7.61) (-3.75)  
OLS (1988-1995) AR2: .09836 SD: 0.028 DW: 1.992

2.1.13 *Other Industry*

TTOI = -546.3205 +56.8831\*LOG(GDE) -12.0795\*LOG(PCLIN/WPI) +67.7632\*DUM94  
(-1.59) (1.80) (-8.04) (14.65)  
+24.4508\*DUM91  
(4.75)  
OLS (1989-1995) AR2: .09796 SD: 3.930 DW: 2.057

### 2.1.14 Industrial Sector Total

$TTIN = TTIR + TTCH + TTINF + TTNM + TTIE + TTMA + TTMN + TTFO + TTPA + TTWO + TTCN + TTTX + TTOI$

### 2.1.15 Electricity for Industry

$ELIN/TTIN = .020219 + .068318 * ((IP + EX)/GDE) + .642472 * (ELIN(-1)/TTIN(-1)) + .018503 * (DUM94)$   
(2.07) (0.73) (2.03) (6.96)  
OLS (1989-1995) AR2: .978 SD: .001867 DW: 1.253

### 2.1.16 Petroleum for Industry

$PTIN/TTIN = -.105073 + .306625 * ((IP + EX)/GDE) + .185018 * (PTIN(-1)/TTIN(-1)) - .011617 * (DUM94)$   
(-6.22) (11.10) (0.49) (-3.98)  
OLS (1990-1995) AR2: .961 SD: .002164 DW: 3.097

### 2.1.17 Coal and Heat for Industry

$(CLIN + HEIN)/TTIN = .362409 - .334394 * ((IP + EX)/GDE)$   
(5.81) (-7.01)  
 $+ .715658 * ((CLIN(-1) + HEIN(-1))/TTIN(-1)) - .058952 * (DUM93) - .017548 * (DUM89)$   
(8.49) (-9.46) (-3.11)  
OLS (1988-1995) AR2: .952 SD: .004890 DW: 2.671

### 2.1.18 Ratio of Coal Use in the Total of Coal and Heat

$RCLHEIN = -.351965 + 3.14876 * ((TTNM + TTCH)/TTIN) + .155564 * (DUM95) - .071680 * (DUM92)$   
(-3.13) (7.93) (4.63) (-2.55)  
OLS (1988-1995) AR2: .964 SD: .026048 DW: 2.655

### 2.1.19 Coal for Industry

$CLIN = (CLIN + HEIN)/TTIN * RCLHEIN$

### 2.1.20 Heat for the Industry

$HEIN = (CLIN + HEIN) - CLIN$

### 2.1.21 Gas for the Industry

$GAIN = TTIN - CLIN - ELIN - HEIN - PTIN$

## 2.2 Final Energy Consumption in the Transportation Sector

### 2.2.1 Petroleum

$PTTR = 7817.47 - 915708.2 * (PGASO/PC) + .068710 * (CP) + 398.523 * (DUM89) + 280.500 * (DUM94)$   
(3.63) (-2.43) (1.64) (2.20) (1.57)  
OLS (1988-1995) AR2: .898 SD: 155.5533 DW: 2.658

### 2.2.2 Electricity

$ELTR = 10.3387 + .005941 * (GDE) - 42.9099 * (DUM93) + 31.2377 * (DUM94)$   
(.13) (4.42) (-2.48) (1.86)  
OLS (1988-1995) AR2: .834 SD: 15.5788 DW: 2.454

### 2.2.3 Transportation Total

$TTTR = PTTR + ELTR + CLTR + HETR$

## 2.3 Final Energy Consumption in the Other Sector

Agriculture, Commercial, and Residential Sector

### 2.3.1 Agriculture

$TTAG = 5031.50 - 2197.14 * (PEXCLZ/PI) + .006275 * (GDE) + 489.768 * (DUM8991) + 287.218 * (DUM94)$   
(2.62) (-1.54) (0.25) (4.87) (2.99)  
OLS (1989-1995) AR2: .914 SD: 83.7160 DW: 3.162

### 2.3.2 Commercial and Residential

TTCM+TTRE=34718.7-41449597\*(PELEH/PC)+.082769\*(GDE)-5930.97\*(DUM90)  
5.66 (-9.61) (0.87) (-5.70)  
+3716.14\*(DUM9293)  
(4.34)

OLS (1988-1995) AR2: .953 SD: 839.0834 DW: 2.5

### 2.3.3 Residential

TTRE/(TTCM+TTRE)=.062386+.029983\*(IP/GDE)+.932627\*(TTRE(-1)/(TTRE(-1)+TTCM(-1)))  
(.52) (0.14) (6.97)  
+.036821\*(DUM94)  
(2.99)

OLS (1989-1995) AR2: .939 SD: .011099 DW: 2.08

### 2.3.4 Commercial

TTCM=(TTCM+TTRE)-TTRE

### 2.3.5 Other Sector Total

TTOT = TTAG+TTCM+TTRE

### 2.3.6 Electricity, Agriculture

ELAG/TTAG=-.274409-.002115\*(TIME)+.151234\*(PEXCLZ/PC)+.033251\*(DUM92)  
(2.63) (-1.99) (3.77) (5.66)

OLS (1988-1995) AR2: .919 SD: .005365 DW: 3.332

### 2.3.7 Electricity, Residential

ELRE/POP=-.094542-14.1708\*(PELEH/PC)+.044892\*(POP/NHO)+.001612\*(DUM91)  
(-2.02) (-1.60) (3.13) (2.29)  
-.001335\*(DUM93)  
(-2.04)

OLS (1990-1995) AR2: .96 SD: .000560 DW: 2.58

### 2.3.8 Electricity, Commercial

ELCM=-1078.31-2440785\*(PELEH/PC)+.102018\*(CP)+142.033\*(DUM93)  
(-2.08) (-2.22) (4.24) (1.76)

OLS (1990-1995) AR2: .836 SD: 71.6936 DW: 3.049

### 2.3.9 Electricity, Total

ELOT=ELAG+ELRE+ELCM

### 2.3.10 Gas

GAOT/TTOT=.075478-.498508\*(PGASH/PSTEAM)+.231067\*(CP/POP)+.068799\*(DUM91)  
(1.09) (-10.33) (3.32) (6.06)  
-.012101\*(DUM90)+.031094\*(DUM93)  
(-1.09) (4.45)

OLS (1988-1995) AR2: .982 SD: .005906 DW: 2.294

### 2.3.11 Coal and Heat

(CLOT+HEOT)/NHO=1.05755+.360966\*(GDE/NHO)-305.311\*(PSTEAM/CPI)-.410857\*(DUM90)  
(1.93) (3.43) (-6.59) (-3.86)  
+.331638\*(DUM92)-.316065\*(DUM95)  
(3.27) (-2.65)

OLS (1988-1995) AR2: .96 SD: .084832 DW: 2.837

### 2.3.12 Heat

HEOT/(HEOT+CLOT)=.005175+.0000093\*(CP)-.030058\*(DUM92)+.025079\*(DUM94)  
(.07) (3.76) (-2.09) (1.65)

OLS (1990-1995) AR2: .867 SD: .012748 DW: 2.484

### 2.3.13 Petroleum

PTOT/NHO=.282176+.155266\*(CP/POP)-.992467\*(PGASO\*100/CPI)+.071060\*(DUM93)



(1.98) (1.25) (-2.99) (3.19)  
 +.057257\*(DUM94)+.026524\*(DUM92)  
 (2.48) (1.15)  
 OLS (1988-1995) AR2: .779 SD: .020232 DW: 2.031

2.3.14 Coal  
 CLOT=TTOT-PTOT-ELOT-GAOT-HEOT

2.3.15 Residential Gas  
 GARE = GAOT\*(GARE(-1)/GAOT(-1))

2.3.16 Residential Heat  
 HERE=HEOT\*(HERE(-1)/HEOT(-1))

## 2.4 Final Energy Consumption in the Non-Energy Use

2.4.1 Petroleum  
 PTNE = 1,086.25 -407.9179\*(PGASO\*1000/PI) +.163589\*(CHEMP)-1,270.53\*DUM93  
 (14.10) (-53.59) (35.42) (-88.35)  
 OLS (1989-1995) AR2: 0.9998 SD: 9.513 DW: 3.211

2.4.2 Gas  
 GANE = -30,378.9 -108.0927\*LOG(PGASH/PI) +2,855.0\*LOG(GDE) -986.5122\*DUM93  
 (-6.62) (-3.94) (6.71) (-11.11)  
 OLS (1988-1995) AR2: 0.9783 SD: 78.317 DW: 2.537

2.4.3 Non-energy Use Total  
 TTNE=PTNE+GANE+CLNE

## 2.5 Final Energy Consumption Total

2.5.1 Coal  
 CLFL=CLIN+CLTR+CLOT+CLNE

2.5.2 Electricity  
 ELFL=ELIN+ELTR+ELOT

2.5.3 Gas  
 GAFL=GAIN+GAOT+GANE

2.5.4 Heat  
 HEFL=HEIN+HETR+HEOT

2.5.5 Petroleum  
 PTFL=PTIN+PTTR+PTOT+PTNE

2.5.6 Total  
 TIFL=CLFL+ELFL+GAFL+HEFL+PTFL

## 2.6 Energy Conversion Sector

### 2.6.1 Distribution Loss

2.6.1.1 Electricity  
 ELLO=ELFL\*RELOFL

2.6.1.2 Rate of Loss for Gas  
 RGALOFI = .008451 -0.000460\*TIME -0.060905\*DUM91 -0.069141\*DUM92 -0.053634\*DUM93

(.06) (-0.32) (-6.91) (-7.64) (-5.64)  
 -029564\*DUM94  
 (-2.91)  
 OLS (1988-1995) AR2: .937 SD: .007853 DW: 2.78

2.6.1.3 Gas  
 GALO=GAFL\*RGALOFL

2.6.1.4 Petroleum  
 PTLO/(PTPT+PTPR)=-.019335-.000226\*(TIME)+.001452\*(DUM95)+.000387\*(DUM91)  
 (8.87) (-9.38) (8.79) (3.04)  
 +.000643\*(DUM93)  
 (4.61)  
 OLS (1988-1995) AR2: .935 SD: .000116 DW: 2.324

2.6.1.5 Coal  
 CLLO/(CLPR)=-.011921+.000124\*(TIME)+.000411\*(DUM90)  
 (-4.61) (4.32) (4.04)  
 -.00051\*(DUM94)+.000126\*(DUM93)-.000374\*(DUM95)  
 (-3.33) (0.95) (-0.97)  
 OLS (1988-1995) AR2: .881 SD: .0000908 DW: 2.86

2.6.1.6 Distribution Loss Total  
 TTLO=CLLO+ELLO+GALO+PTLO

2.6.2 Own Use

2.6.2.1 Coal  
 CLOW/CLPR=-.003506-.000135\*(TIME)-.019590\*(DUM94)-.018583\*(DUM95)  
 (-.08) (-0.29) (-7.29) (-6.20)  
 OLS (1988-1995) AR2: .954 SD: .001966 DW: 2.398

2.6.2.2 Electricity  
 ELOW=ELFL\*RELOWFL

2.6.2.3 Ratio of Own Use at Gas Works  
 RGAOW=.284801-.003629\*(TIME)-.031958\*(DUM92)-.010486\*(DUM91)  
 (5.46) (-6.37) (-8.04) (-2.64)  
 OLS (1988-1995) AR2: .941 SD: .003672 DW: 2.039

2.6.2.4 Gas  
 GAOW=(GAFL-GALO)\*RGAOW

2.6.2.5 Heat  
 HEOW=-626.928+.047227\*((HEFL-HEFT-HESD)\*(-1))-134.212\*(DUM91)  
 (-8.55) (10.60) (-5.38)  
 10.7459\*(DUM93)+199.701\*(DUM95)  
 (-0.37) (4.91)  
 OLS (1988-1995) AR2: .99 SD: 22.7406 DW: 1.938

2.6.2.6 Petroleum  
 PTOW=680.461+.007218\*((PTFL-PTLO-PTEH-PTSD)\*(-1))-67.0754\*(DUM93)-7.12245\*(TIME)  
 (9.47) (5.20) (-12.69) (-9.38)  
 OLS (1988-1995) AR2: .982 SD: 4.76692 DW: 2.696

2.6.2.7 Own Use Total  
 TTOW=CLOW+ELOW+GAOW+HEOW+PTOW

2.6.3 Oil Refinery

2.6.3.1 Petroleum Products Output  
 PTPT=PTFL+(PTLO+PTOW+PTSD+PTEH+PTGW)\*(-1)-PTPR

### 2.6.3.2 Input total for Petroleum Products

$$\#INPPT=PIPT/RCONVP*(-1)$$

### 2.6.3.3 Conversion Loss

$$TIPT=(\#INPPT+PIPT)$$

### 2.6.3.4 Crude Oil Input

$$CRPT/PTPT=-.501338-.005978*(TIME)-.058513*(DUM95)-.015709*(DUM92)$$

(-9.54) (-10.34) (-14.51) (-4.75)

OLS (1988-1995) AR2: .991 SD: .002995 DW: 2.934

### 2.6.3.5 Electricity Input

$$ELPT=-9.88457-.001977*(PTPT)-4.84930*(DUM94)-10.2052*(DUM95)$$

(-5.46) (-14.44) (-10.19) (-21.84)

OLS (1988-1995) AR2: .992 SD: .428047 DW: 2.048

### 2.6.3.6 Heat Input

$$HEPT=-465.394+.012333*(PTPT)-172.780*(DUM95)$$

(-5.61) (1.91) (-9.90)

OLS (1990-1995) AR2: .951 SD: 15.0391 DW: 1.465

### 2.6.3.7 Coal Input

$$CLPT=54.3000-.610000*(TIME)-26.9500*(DUM95)$$

OLS (1990-1995) AR2: .965 SD: 2.22314 DW: 3.124

### 2.6.3.8 Gas Input

$$GAPT=\#INPPT-(CRPT+ELPT+HEPT+CLPT)$$

## 2.6.4 GAS Work

### 2.6.4.1 Gas Output

$$GAGW=2053.59+.019875*(GAFI)-22.7665*(TIME)-26.5993*(DUM93)+6.18318*(DUM95)$$

(18.60) (16.76) (-19.20) (-4.01) (0.73)

OLS (1988-1995) AR2: .994 SD: 5.30788 DW: 2.901

### 2.6.4.2 Coal Input

$$CLGW=(ITGW-GAGW)-(PTGW)$$

### 2.6.4.3 Petroleum Input

$$PTGW=-7.35741+.026199*(ITGW+GAGW)+1.17203*(DUM92)+.533791*(DUM93)$$

(-64.07) (23.31) (5.00) (2.39)

OLS (1990-1995) AR2: .992 SD: 197423 DW: 2.534

### 2.6.4.4 Conversion Loss

$$TTGW=GAGW*RTTGW$$

## 2.6.5 Electricity and Heat Supply(CHP, DH)

### 2.6.5.1 Electricity Output

$$ELEH=ELFL+(ELLO+ELOW+ELPT+ELSD)*(-1)-ELPR$$

### 2.6.5.2 Heat Output

$$HEEH=HEFL+(HELO+HEOW+HEPT+HESD)*(-1)$$

### 2.6.5.3 Energy Conversion Ratio

$$RCONVEH=.684565-.330594*(ELEH/(HEEH+ELEH))$$

(47.22) (-10.05)

OLS (1990-1995) AR2: .952 SD: .004405 DW: 2.964

### 2.6.5.4 Input Total

$$INPELHE=(ELEH+HEEH)/RCONVEH$$

$$\#INP=INPELHE*(-1)$$

2.6.5.5 Coal Input

CLEH=#INP-(GAEH+HYEH+PTEH)

2.6.5.6 Conversion Loss

TTEH=#INP+ELEH+HEEH

2.7 Primary Energy

2.7.1 Primary Energy Requirement

2.7.1.1 Coal

CLPR=CLFL+(CLLO+CLOW+CLCL+CLPT+CLGW+CLEH+CLSD)\*(-1)

2.7.1.2 Crude Oil

CRPR=(CRPT+CRSD)\*(-1)

2.7.1.3 Electricity

ELPR=ELIM+ELEX

2.7.1.4 Gas

GAPR=GAFI+(GALO+GAOW+GACL+GAGW+GAEH+GASD)\*(-1)

2.7.1.5 Hydro

HYPR=-1\*HYEH

2.7.1.6 Petroleum Products

PTPR=PTIM+PTEX+PTSC

2.7.1.7 Total

TTPR=CLPR+CRPR+ELPR+GAPR+HYPR+PTPR

2.7.2 Export

2.7.2.1 Coal

CLEX=CLPR-CLPD-CLIM-CLSC

2.7.2.2 Petroleum Products

PTEX=-923.256-.032826\*((PTPT-PTFL))-492.316\*(DUM9091)

(-30.18) (-1.67) (-11.81)

OLS (1989-1995) AR2: .958 SD: 48.7193 DW: .934

2.7.2.3 Total

TTEX=CLEX+ELEX+GAEX+PTEX

2.7.3 Import

2.7.3.1 Gas

GAIM=GAPR-GAPD-GAEX-GASC

2.7.3.2 Petroleum

PTIM=10676.7+.056631\*(PTFL)-100.329\*(TIME)-802.929\*(DUM92)-419.863\*(DUM93)

(5.16) (1.09) (-4.61) (-5.07) (-2.29)

OLS (1988-1995) AR2: .915 SD: 135.6512 DW: 2.433

2.7.3.3 Crude Oil

CRIM=CRPR-CRPD-CRSC

2.7.3.4 Total

TTIM=CLIM+CRIM+ELIM+GAIM+PTIM

2.7.4 Production

2.7.4.1 Hydro

HYPD=HYPR

2.7.4.2 Total

$$TTPD=CLPD+CRPD+GAPD+HYPD$$

## 2.8 Revenue of Energy Sales

### 2.8.1 Coal

$$RENECL=(CLPR/4200/1000)*PCLIN*10000$$

### 2.8.2 Petroleum

$$RENEPT=((PTTR/8800*PGASO)+((PTPT-PTTR)/9700/1000)*PHOIN)*10000$$

### 2.8.3 Gas

$$RENEGA=((GARE/8100*PGASII)+((GAPR+GAGW-GARE)/8100*(PGASIN/1000)))*10000$$

### 2.8.4 Electricity

$$RENEEL=(ELRE/860*PELEH)+(ELCM/860*PELECM)+((ELEH-ELRE-ELCM)/860*(PELEIN/1000))*10000$$

### 2.8.5 Heat

$$RENEHE=(ASPCHE*PSTEAM*12/1000)+((HEEH-HERE)/236633*PSTEMIN)*10000$$

### 2.8.6 Energy Total

$$RENETT=RENECL+RENEPT+RENEGA+RENEEL+RENEHE$$

## 2.9 Incremental Value Added by the Energy Industry

*Revenue of the Government due to Price Change*

*The increasing ratio of the energy industries costs are assumed to be just half of CPI increase.*

$$\#R1=(CPI/CPIB-1)*CRATE$$

$$\#R2=(1+\#R1)$$

$$RENECPI=RENEB*\#R2$$

$$RINCLENE=RENETT-RENECPI$$

## 2.10 Secondary Energy Price

### 2.10.1 Increasing Ratio for Energy Carrier

$$\#RPCL=((WPI/WPI(-1))-1)+(APCLIN/100)$$

#### 2.10.1.1 Increasing Ratio for Electricity

$$\#RPEL=((WPI/WPI(-1))-1)+(APELEH/100)$$

#### 2.10.1.2 Increasing Ratio for Gas

$$\#RPGA=((WPI/WPI(-1))-1)+(APGASH/100)$$

#### 2.10.1.3 Increasing Ratio for Heavy Fuel Oil

$$\#RPFL=((WPI/WPI(-1))-1)+(APHOIN/100)$$

#### 2.10.1.4 Increasing Ratio for Gasoline

$$\#RPGASO=((WPI/WPI(-1))-1)+(APGASO/100)$$

#### 2.10.1.5 Increasing Ratio for Heat

$$\#RPSM=((WPI/WPI(-1))-1)+(APSTEAM/100)$$

#### 2.10.1.6 Increasing Ratio for Gasoline

### 2.10.2 Price of Each Energy Carrier

#### 2.10.2.1 Price of Coal for Industry

$$PCLIN=PCLIN(-1)*(\#RPCL+1)$$

2.10.2.2 Price of Coal for Industry

$$\text{PEXCLZ}=\text{PEXCLZ}(-1)* (\#\text{RPCL}+1)$$

2.10.2.3 Price of Electricity for House

$$\text{PELEH}=\text{PELEH}(-1)* (\#\text{RPEL}+1)$$

2.10.2.4 Price of Electricity for Industry

$$\text{PELEIN}=\text{PELEIN}(-1)* (\#\text{RPEL}+1)$$

2.10.2.5 Price of Electricity for Commercial

$$\text{PELECM}=\text{PELECM}(-1)* (\#\text{RPEL}+1)$$

2.10.2.6 Price of Gas for House

$$\text{PGASH}=\text{PGASH}(-1)* (\#\text{RPGA}+1)$$

2.10.2.7 Price of Gas for Industry

$$\text{PGASIN}=\text{PGASIN}(-1)* (\#\text{RPGA}+1)$$

2.10.2.8 Price of Heavy Oil for Industry

$$\text{PHOIN}=\text{PHOIN}(-1)* (\#\text{RPFL}+1)$$

2.10.2.9 Price of Gasoline

$$\text{PGASO}=\text{PGASO}(-1)* (\#\text{RPGASO}+1)$$

2.10.2.10 Price of Heat for House

$$\text{PSTEAM}=\text{PSTEAM}(-1)* (\#\text{RPSM}+1)$$

2.10.2.11 Price of Heat for Industry

$$\text{PSTEMIN}=\text{PSTEMIN}(-1)* (\#\text{RPSM}+1)$$

## 2.11 Other Indices

2.11.1 Number of Population per Household

$$\text{POP NHO}=4.82973-.018283*(\text{TIME})$$

(130.97) (-45.38)

OLS (1988-1995) AR2: .997 SD: .002611 DW: .838

2.11.2 Number of Household

$$\text{NHO}=\text{POP}/\text{POP NHO}$$

2.11.3 CO<sub>2</sub> Emission

$$\text{CO2}=1.096*\text{CLPR}+0.903*(\text{CRPR}+\text{PTPR})+0.632*\text{GAPR}$$

## Appendix 9-2 Energy Balance Table in Poland (JICA Version)

Item	Energy	Year	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Production	Coal	CLPD	97,759	100,955	106,446	110,713	114,904	118,667	122,807	118,059	100,625	116,046	118,109	120,086	121,709
	Crude Oil	CRPD	398	558	562	462	370	369	336	390	370	245	213	189	263
	Gas	GAPD	4,253	4,116	4,072	5,270	5,260	5,276	4,858	5,037	5,289	4,452	4,366	4,675	5,093
	Hydro	HYPD	159	210	204	180	205	205	211	281	258	223	285	287	334
	Total	TPPD	102,569	105,839	111,283	116,625	120,739	124,516	128,212	123,767	106,543	120,965	122,973	125,238	127,398
Import	Coal	CLJM	603	623	566	555	562	536	487	525	558	503	528	690	705
	Crude Oil	CRIM	11,767	11,193	13,966	15,842	17,184	17,422	17,480	17,306	14,354	13,973	13,853	14,251	14,324
	Electricity	ELIM	174	150	207	233	267	405	396	360	364	369	353	402	473
	Gas	GAIM	1,186	1,481	1,847	1,898	2,063	1,955	3,047	3,942	3,694	4,209	4,499	4,698	4,452
	Petroleum	PTIM	1,858	1,867	1,747	2,014	2,030	2,151	2,577	3,164	2,973	2,456	2,462	2,864	2,797
	Total	TTIM	15,588	15,314	18,333	20,542	22,106	22,469	23,987	25,298	21,943	21,509	21,695	22,906	22,751
Export	Coal	CLEX	-22,256	-24,685	-23,426	-23,697	-23,704	-23,616	-24,499	-18,172	-9,395	-16,610	-20,022	-24,396	-20,639
	Electricity	ELEX	-324	-386	-251	-242	-265	-439	-434	-378	-363	-512	-618	-795	-651
	Gas	GAEX	0	0	0	0	0	0	0	0	0	0	0	0	0
	Petroleum	PTEX	-1,232	-1,053	-1,479	-2,505	-2,008	-1,769	-1,429	-1,637	-731	-519	-403	-390	-365
	Total	TTEX	-23,812	-26,125	-25,156	-26,443	-25,977	-25,825	-26,362	-20,187	-10,489	-17,641	-21,042	-25,580	-21,654
Stock Change & Bunker	Coal	CLSC	-152	2,728	-998	378	-534	361	1,970	1,366	1,323	-5,693	-3,126	5,761	3,401
	Crude Oil	CRSC	-778	255	-204	-184	-387	-81	-440	-723	-382	-180	252	-339	9
	Gas	GASC	-39	-34	-39	-66	-50	-41	-40	-113	-26	-28	-21	-98	-86
	Petroleum	PTSC	-516	-428	-348	-95	-309	-364	-756	-590	-753	-864	-759	-933	-97
	Total	TTSC	-1,484	2,521	-1,589	34	-1,280	-125	734	-60	163	-6,765	-3,653	4,390	2,350
Primary Energy Requirement	Coal	CLPR	75,954	79,621	82,588	87,950	91,228	95,947	100,766	101,778	93,112	94,245	95,490	102,141	105,176
	Crude Oil	CRPR	11,388	12,006	14,324	16,120	17,166	17,710	17,377	16,973	14,342	14,038	14,318	14,101	14,596
	Electricity	ELPR	-150	-236	-44	-9	2	-34	-38	-20	-4	-145	-267	-396	-182
	Gas	GAPR	5,401	5,562	5,880	7,102	7,272	7,189	7,864	8,866	8,957	8,633	8,843	9,275	9,459
	Hydro	HYPR	158	209	202	178	204	203	210	281	259	223	285	288	334
	Petroleum	PTPR	110	386	-79	-585	-286	17	391	937	1,489	1,073	1,301	1,541	1,458
Total	TTPR	92,860	97,548	102,871	110,755	115,586	121,033	126,570	128,814	118,156	118,067	119,970	126,950	130,841	
Statistical Difference	Coal	CLSD	751	-120	321	321	-89	-675	-4,991	-3,956	-3,140	-2,233	-3,573	-6,456	-6,861
	Crude Oil	CRSD	549	-69	-311	-82	-473	-391	-357	-932	-941	-836	-873	-824	-934
	Electricity	ELSD	-478	-469	-521	-538	-513	-573	-582	-276	-775	-377	-447	-689	-557
	Gas	GASD	-610	-599	-662	-688	-731	-613	-671	-1,514	-1,923	-1,708	-1,804	-1,946	-1,976
	Heat	HESD	9	-69	97	-191	-99	-69	62	520	141	138	383	434	339
	Petroleum	PTSD	-1,369	-534	-447	-1,072	-639	-573	-469	-932	284	56	276	318	266
Total	TTSD	-1,148	-1,860	-1,522	-2,250	-2,544	-2,894	-7,006	-7,090	-6,355	-4,959	-6,039	-9,163	-9,723	
Electricity & Heat	Coal	CLEH	-39,459	-41,981	-43,940	-47,378	-50,078	-53,063	-54,944	-55,693	-50,533	-51,821	-54,473	-58,467	-60,491
	Electricity	ELEH	7,228	7,854	8,332	8,925	9,377	9,908	10,071	10,447	9,852	10,078	10,789	11,565	11,814
	Gas	GAEH	-808	-832	-1,016	-1,253	-1,084	-1,359	-1,435	-883	-831	-693	-743	-766	-754
	Heat	HEEH	15,698	16,728	17,372	18,924	20,003	21,215	22,181	22,505	21,148	21,014	21,434	22,094	23,058
	Hydro	HYEH	-158	-210	-203	-179	-205	-204	-210	-280	-257	-223	-284	-287	-33
	Petroleum	PTEH	-1,290	-1,430	-1,583	-1,867	-2,103	-2,408	-2,669	-1,920	-2,272	-2,069	-2,028	-2,061	-2,068
Total	TTEH	-18,789	-19,872	-21,039	-22,830	-24,090	-25,911	-27,006	-25,825	-22,892	-23,714	-25,306	-27,922	-28,774	
Gas Work	Coal	CLGW	-2,370	-2,150	-2,017	-1,888	-1,720	-1,722	-1,592	-1,490	-1,365	-1,065	-1,047	-1,062	-937
	Gas	GAGW	111	158	117	110	-216	141	170	693	624	510	464	508	488
	Petroleum	PTGW	0	0	0	0	0	0	0	-5	-5	-6	-5	-5	-4
	Total	TTGW	-2,259	-1,992	-1,900	-1,779	-1,935	-1,581	-1,421	-802	-747	-561	-589	-560	-453
Petroleum Refinery	Coal	CLPT	0	0	0	0	0	0	0	0	0	-2	-1	-1	-1
	Coal	CRPT	-11,937	-11,937	-14,013	-16,038	-16,693	-17,319	-17,020	-16,041	-13,401	-13,202	-13,445	-13,277	-13,662
	Electricity	ELPT	-46	-26	-27	-34	-36	-40	-37	-34	-31	-32	-35	-34	-35
	Gas	GAPT	0	0	0	0	0	0	0	-42	-36	-34	-37	-36	-35
	Heat	HEPT	0	0	0	0	0	0	0	-393	-368	-343	-376	-370	-393
	Petroleum	PTPT	11,378	11,029	12,675	14,753	14,953	15,680	15,476	14,651	12,072	11,953	12,244	12,184	12,335
Total	TTPT	-605	-935	-1,364	-1,319	-1,776	-1,679	-1,582	-1,859	-1,764	-1,660	-1,650	-1,535	-1,792	
Coal Transformation	Coal	CLCL	-513	-555	-688	-806	-911	-1,055	-932	-464	-303	-706	-443	-256	-370
	Gas	GACL	-18	-20	-24	-28	-32	-37	-33	-16	-11	-25	-16	-9	-13
	Total	TTCL	-531	-574	-712	-834	-943	-1,092	-965	-480	-313	-731	-459	-265	-383

(Unit: 1000 TOE)

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996			
124,003	125,815	123,327	113,955	96,847	93,002	91,487	91,446	93,207	94,835	98,493	CLPD	Coal	Production
342	374	176	179	175	173	215	254	323	292	396	CRPD	Crude Oil	
4,744	4,952	3,740	3,464	2,378	2,658	2,585	3,304	3,099	3,169	3,276	GAPD	Gas	
325	348	360	322	284	292	306	128	149	163	166	HYPD	Hydro	
129,414	131,489	127,604	117,919	99,684	96,125	94,594	95,131	96,777	98,459	102,331	TTPD	Total	
777	737	723	624	374	36	85	87	707	1,074	1,399	CLIM	Coal	Import
14,645	14,650	15,605	15,391	13,579	11,965	13,537	13,992	13,192	13,570	15,205	CRIM	Crude Oil	
679	902	1,074	1,041	900	579	429	478	392	375	413	ELIM	Electricity	
5,272	5,549	6,037	6,389	6,797	5,343	5,344	4,705	5,001	5,836	6,396	GAIM	Gas	
2,920	2,744	2,515	2,637	2,323	2,176	1,301	1,534	1,839	2,004	3,895	PTIM	Petroleum	
24,292	24,581	25,954	26,082	23,972	20,099	20,696	20,797	21,132	22,857	27,308	TTIM	Total	
-19,851	-17,721	-20,612	-18,815	-18,671	-13,847	-14,401	-16,069	-19,997	-22,289	-19,496	CLEX	Coal	Export
-671	-749	-686	-882	-986	-800	-779	-688	-623	-615	-681	ELEX	Electricity	
0	-1	-0	-1	-1	-0	-3	-13	-20	-25	-34	GAEX	Gas	
-302	-365	-617	-1,013	-1,482	-1,392	-914	-1,025	-916	-927	-1,201	PTEX	Petroleum	
-20,824	-18,835	-21,916	-20,711	-21,140	-16,040	-16,096	-17,796	-21,556	-23,857	-21,412	TTEX	Total	
1,328	1,559	-877	1,431	-30	-661	-310	2,312	-1,135	586	-609	CLSC	Coal	Stock Change
-146	-135	-267	215	-543	51	-57	-522	441	193	809	CRSC	Crude Oil	& Bunker
-64	-89	-98	-358	-258	-57	-110	223	137	15	7	GASC	Gas	
-920	-914	-1,202	-1,138	-460	119	-64	-17	-97	384	-304	PTSC	Petroleum	
197	421	-2,444	150	-1,292	-548	-542	1,997	-654	1,178	-97	TTSC	Total	
106,256	110,390	102,562	97,195	78,520	78,530	76,861	77,776	72,782	74,205	79,787	CLPR	Coal	Primary
14,840	14,889	15,514	15,785	13,211	12,189	13,695	13,724	13,956	14,055	16,410	CRPR	Crude Oil	Energy
3	148	384	154	-89	-225	-346	-207	-230	-241	-269	ELPR	Electricity	Requirement
9,952	10,410	9,679	9,494	8,915	7,944	7,817	8,219	8,218	8,995	9,645	GAPR	Gas	
326	348	359	321	283	292	305	127	149	163	166	HYPH	Hydro	
1,697	1,465	696	486	381	903	322	492	826	1,461	2,391	PTPR	Petroleum	
133,075	137,651	129,194	123,435	101,220	99,634	98,653	100,131	95,700	98,637	108,130	TTPR	Total	
-6,199	-5,765	337	1,593	4,680	3,912	3,984	-420	1,546	30	-2,110	CLSD	Coal	Statistical
-900	-763	-126	-1,133	-299	-361	-710	959	974	1,351	1,031	CRSD	Crude Oil	Difference
-1,006	-1,289	-1,189	-1,322	-924	-812	-707	-445	-0	0	0	ELSD	Electricity	
-1,900	-1,899	-337	-348	-3,008	-2,966	-3,263	-84	127	-261	655	GASD	Gas	
333	242	384	354	485	375	352	358	968	1,020	1,011	HESD	Heat	
390	371	-167	797	226	444	587	-2,164	-308	-920	-925	PTSD	Petroleum	
-9,283	-9,101	-1,099	-58	1,160	591	244	-1,797	3,307	1,221	-339	TTSD	Total	
-60,593	-62,407	-60,485	-56,236	-52,108	-51,338	-49,037	-46,383	-44,985	-41,992	-43,458	CLEH	Coal	Electricity
12,040	12,507	12,405	12,491	11,700	11,564	11,397	11,328	11,461	11,783	12,141	ELEH	Electricity	& Heat
-605	-646	-537	-521	-521	-393	-234	-76	-99	-114	-173	GAEH	Gas	
22,835	23,484	20,029	19,480	18,518	18,125	17,096	14,229	13,348	9,928	10,533	HEEH	Heat	
-325	-347	-360	-321	-283	-292	-306	-127	-149	-163	-166	HYEH	Hydro	
-1,977	-2,099	-1,803	-1,742	-1,601	-1,505	-1,384	-1,351	-1,372	-630	-694	PTEH	Petroleum	
-28,625	-29,507	-30,751	-26,848	-24,295	-23,838	-22,468	-22,381	-21,795	-21,186	-21,818	TTEH	Total	
-855	-818	-638	-674	-354	-231	-175	-112	-79	-66	-45	CLGW	Coal	Gas Work
436	438	223	183	105	59	31	49	61	53	37	GAGW	Gas	
-5	-5	-14	-1	-12	-10	-9	-7	-7	-6	-6	PTGW	Petroleum	
-424	-386	-429	-492	-261	-182	-153	-71	-25	-20	-15	TTGW	Total	
-1	-1	-1	-1	-1	-0	-1	-6	-2	-31	-33	CLPT	Coal	Petroleum
-13,940	-14,127	-15,388	-14,652	-12,912	-11,828	-12,985	-14,682	-14,931	-15,406	-17,439	CRPT	Coal	Refinery
-30	-30	-40	-37	-34	-32	-34	-38	-42	-47	-51	ELPT	Electricity	
-36	-33	-59	-55	-40	-37	-36	-39	-38	-37	-42	GAPT	Gas	
-300	-303	-397	-919	-335	-317	-308	-288	-291	-470	-475	HEPT	Heat	
12,499	12,941	14,967	14,177	12,407	11,339	12,169	13,937	13,992	13,661	15,247	PTPT	Petroleum	
-1,808	-1,553	-918	-1,488	-916	-876	-1,194	-1,116	-1,312	-2,330	-2,793	TTPT	Total	
-431	-422	-953	-954	-912	-772	-744	-780	-906	-1,228	-1,070	CLCL	Coal	Coal
-15	-15	-34	-34	-32	-27	-26	-27	-32	-26	-44	GACL	Gas	Transformation
-446	-437	-986	-987	-944	-800	-770	-807	-938	-1,254	-1,114	TTCL	Total	



Item	Energy	Year	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Own Use	Coal	CLOW	-1,384	-1,498	-1,447	-1,408	-1,454	-1,875	-1,002	-1,770	-1,546	-1,526	-1,555	-1,487	-1,514
	Electricity	ELOW	-1,328	-1,414	-1,462	-1,609	-1,696	-1,801	-1,851	-1,747	-1,659	-1,745	-1,929	-2,035	-2,101
	Gas	GAOW	-26	-39	-93	-132	-152	-13	-12	-23	-17	-21	-33	-33	-23
	Heat	HEOW	-1,610	-1,715	-1,860	-1,859	-1,917	-1,957	-1,752	-1,226	-1,129	-1,187	-1,204	-1,149	-1,192
	Petroleum	PTOW	-48	-50	-55	-53	-56	-73	-79	-66	-67	-67	-73	-92	-103
	Total	TTOW	-4,395	-4,716	-4,916	-5,060	-5,276	-5,719	-4,696	-4,833	-4,418	-4,546	-4,794	-4,796	-4,933
Distribution Loss	Coal	CLLO	-27	-36	-41	-33	-33	-72	-35	-44	-28	-40	-62	-53	-58
	Electricity	ELLO	-624	-675	-727	-833	-854	-963	-957	-1,049	-927	-913	-1,209	-1,169	-1,231
	Gas	GALO	-181	-224	-216	-138	-231	-263	-201	-309	-267	-193	-286	-252	-233
	Heat	HELO	0	0	0	0	0	0	0	0	0	0	0	0	0
	Petroleum	PTLO	-7	-9	-6	-10	-10	-10	-11	-17	-21	-11	-16	-13	-13
	Total	TTLO	-840	-945	-989	-1,014	-1,127	-1,308	-1,205	-1,419	-1,244	-1,158	-1,572	-1,487	-1,536
Final Energy Consumption	Coal	CLFL	32,952	33,280	34,775	36,758	36,944	37,486	37,271	38,360	36,196	36,853	34,336	34,359	34,944
	Electricity	ELFL	4,602	5,033	5,552	5,902	6,280	6,498	6,606	7,320	6,456	6,867	6,901	7,242	7,708
	Gas	GAFI	3,869	4,007	3,986	4,973	4,826	5,045	5,682	6,772	6,497	6,469	6,389	6,742	6,914
	Heat	HEFL	14,097	14,943	15,610	16,874	17,987	19,188	20,492	21,406	19,792	19,621	20,238	21,008	21,811
	Petroleum	PTFL	8,773	9,390	10,505	11,166	11,859	12,632	12,638	12,647	11,479	10,927	11,699	11,871	11,870
	Total	TTFL	64,293	66,653	70,428	75,672	77,896	80,850	82,689	86,505	80,420	80,738	79,562	81,222	83,247
Industrial Sector	Coal	CLIN	10,597	10,447	10,504	10,785	11,717	11,661	11,746	11,799	10,772	9,369	9,746	10,066	9,472
	Electricity	ELIN	3,035	3,329	3,691	3,936	4,335	4,286	4,288	4,269	3,812	3,677	3,870	3,990	3,991
	Gas	GAIN	3,643	3,694	3,372	4,682	4,644	3,698	4,192	4,868	4,442	4,242	4,393	4,490	4,413
	Heat	HEIN	9,896	10,003	10,518	10,956	12,074	12,820	13,506	14,615	13,051	12,723	12,478	13,317	13,706
	Petroleum	PTIN	1,768	1,919	2,373	2,393	2,419	2,455	2,454	2,574	2,205	2,055	1,941	2,097	2,110
	Total	TTIN	28,938	29,392	30,458	32,753	35,190	34,921	36,186	38,124	34,283	32,066	32,428	33,960	33,659
Iron/Steel	Coal	CLIR	4,151	4,165	4,258	4,370	5,162	5,669	6,153	6,048	5,407	4,317	4,760	4,906	4,791
	Electricity	ELIR	523	549	590	630	719	735	753	756	654	642	684	713	716
	Gas	GAIR	1,460	1,512	1,335	1,440	1,803	1,115	1,487	2,117	1,837	1,697	1,792	1,825	1,832
	Heat	HEIR	1,810	1,471	1,393	1,508	1,907	2,021	2,204	2,608	2,343	2,205	2,340	2,527	2,451
	Petroleum	PTIR	688	711	831	842	841	758	766	719	656	557	464	559	554
	Total	TTIR	8,632	8,409	8,407	8,789	10,432	10,297	11,363	12,248	10,898	9,418	10,038	10,531	10,344
Chemical	Coal	CLCH	499	474	470	460	420	358	288	320	290	325	264	268	255
	Electricity	ELCH	561	581	619	646	657	669	643	640	605	604	622	629	597
	Gas	GACH	837	853	1,065	1,053	1,001	1,032	1,064	1,142	1,075	1,090	1,072	1,088	1,081
	Heat	HECH	2,192	2,283	2,424	2,534	2,799	2,909	2,852	3,117	3,387	3,235	2,889	3,027	3,144
	Petroleum	PTCH	7	7	8	8	9	11	12	16	11	9	9	9	9
	Total	TTCH	4,096	4,197	4,585	4,701	4,886	4,978	4,858	5,236	5,368	5,263	4,857	5,022	5,087
Non-Ferrous Metal	Coal	CLNF	583	580	603	574	562	542	502	520	426	388	359	328	342
	Electricity	ELNF	385	402	432	449	464	481	492	507	415	404	421	430	440
	Gas	GANF	0	0	94	0	0	0	0	195	201	177	184	186	177
	Heat	HENF	207	222	229	225	239	267	267	307	283	262	262	269	261
	Petroleum	PTNF	57	58	58	55	53	52	50	46	43	31	30	31	31
	Total	TTNF	1,231	1,261	1,417	1,303	1,318	1,342	1,312	1,574	1,368	1,262	1,255	1,244	1,252
Non-Metallic Mineral	Coal	CLNM	3,995	3,958	3,896	4,102	4,291	3,813	3,504	3,670	3,370	3,211	3,276	3,425	3,022
	Electricity	ELNM	0	0	335	0	0	0	0	376	304	294	319	330	321
	Gas	GANM	0	0	415	0	0	0	0	785	729	684	736	757	703
	Heat	HENM	0	0	815	0	0	0	0	910	877	864	833	879	882
	Petroleum	PTNM	0	0	532	0	0	0	0	492	322	245	245	213	228
	Total	TTNM	3,995	3,958	5,994	4,102	4,291	3,813	3,504	6,232	5,602	5,299	5,410	5,604	5,158
Transport Equipment	Coal	CLTE	0	0	0	0	0	0	0	0	0	0	0	0	0
	Electricity	ELTE	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gas	GATE	0	0	0	0	0	0	0	0	0	0	0	0	0
	Heat	HETE	0	0	0	0	0	0	0	0	0	0	0	0	0
	Petroleum	PTTE	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	TTTE	0	0	0	0	0	0	0	0	0	0	0	0	0
Machinery	Coal	CLMA	478	472	695	509	548	586	572	697	680	510	497	489	509
	Electricity	ELMA	0	0	808	0	0	0	0	874	802	730	758	790	806
	Gas	GAMA	0	0	392	0	0	0	0	547	526	521	529	550	542
	Heat	HEMA	0	0	1,469	0	0	0	0	2,385	1,584	1,574	1,699	1,885	1,972
	Petroleum	PTMA	0	0	134	0	0	0	0	168	192	154	137	127	169
	Total	TTMA	478	472	3,498	509	548	586	572	4,670	3,784	3,489	3,619	3,842	3,998

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996			
-1,490	-1,479	-1,594	-1,533	-1,336	-1,095	-1,054	-1,426	-2,604	-2,591	-2,477	CLOW	Coal	Own Use
-2,184	-2,271	-2,675	-2,587	-2,421	-2,447	-2,380	-2,188	-2,374	-2,239	-2,236	ELOW	Electricity	
-33	-15	-267	-322	-240	-243	-321	-421	-414	-485	-786	GAOW	Gas	
-1,197	-1,326	-1,494	-1,462	-1,441	-1,544	-1,399	-1,251	-1,187	-856	-1,041	HEOW	Heat	
-99	-98	-62	-53	-52	-59	-62	-152	-100	-102	-85	PTOW	Petroleum	
-5,002	-5,189	-6,092	-5,958	-5,491	-5,388	-5,216	-5,438	-6,679	-6,272	-6,625	TTOW	Total	
-71	-113	-102	-82	-27	-57	-33	-19	-56	-37	-30	CLLO	Coal	Distribution
-1,158	-1,287	-1,193	-1,115	-909	-1,203	-1,300	-1,455	-1,488	-1,554	-1,551	ELLO	Electricity	Loss
-196	-310	-261	-214	-208	-374	-371	-616	-473	-264	-837	GALO	Gas	
0	0	0	0	0	0	0	0	0	0	0	HELO	Heat	
-12	-18	-10	-9	-12	-10	-19	-15	-28	-10	0	PTLO	Petroleum	
-1,437	-1,727	-1,566	-1,420	-1,156	-1,644	-1,722	-2,106	-2,044	-1,865	-2,417	TTLO	Total	
36,615	39,386	39,126	39,309	28,462	28,949	29,802	28,630	25,697	28,291	30,564	CLFL	Coal	Final Energy
7,665	7,778	7,691	7,584	7,323	6,845	6,630	6,995	7,326	7,703	8,035	ELFL	Electricity	Consumption
7,603	7,932	8,407	8,183	4,971	3,964	3,597	7,004	7,350	7,862	8,454	GAFL	Gas	
21,672	22,097	18,522	17,454	17,227	16,638	15,741	13,048	12,838	9,623	10,028	HEFL	Heat	
12,493	12,558	13,608	13,655	11,336	11,100	11,605	10,739	13,004	13,454	15,928	PTFL	Petroleum	
86,048	89,750	87,354	86,184	69,319	67,497	67,376	66,416	66,214	66,933	73,009	TTFL	Total	
9,548	9,383	10,988	10,324	8,518	7,477	7,124	10,049	10,014	13,459	14,463	CLIN	Coal	Industrial Sector
3,984	4,028	3,966	3,767	3,234	2,867	2,710	3,027	3,390	3,612	3,971	ELIN	Electricity	
4,911	4,743	3,385	3,025	2,438	1,836	1,498	2,685	1,971	1,949	2,552	GAIN	Gas	
13,808	13,839	11,272	10,869	9,734	8,950	8,039	5,238	5,177	2,612	2,516	HEIN	Heat	
1,954	2,000	1,159	1,044	784	623	585	780	679	1,326	1,823	PTIN	Petroleum	
34,204	33,992	30,770	29,029	24,708	21,752	19,955	21,778	21,230	22,958	25,325	TTIN	Total	
5,195	5,146	4,844	4,348	3,921	3,039	3,085	3,487	3,752	4,313	3,959	CLIR	Coal	Iron/Steel
741	754	722	672	615	517	452	565	621	647	655	ELIR	Electricity	
2,063	1,852	1,746	1,469	1,175	726	492	535	579	555	581	GAIR	Gas	
2,445	2,319	1,629	1,812	1,856	1,542	1,453	734	712	485	440	HEIR	Heat	
513	504	418	350	248	174	118	107	79	70	46	PTIR	Petroleum	
10,957	10,576	9,360	8,651	7,816	5,999	5,600	5,428	5,742	6,070	5,681	TTIR	Total	
252	236	132	149	113	98	110	234	244	1,694	1,644	CLCH	Coal	Chemical
612	619	596	582	494	419	410	517	773	809	819	ELCH	Electricity	
1,303	1,348	87	82	72	60	61	1,069	110	154	151	GACH	Gas	
3,242	3,257	2,497	2,448	2,105	1,909	1,883	1,681	2,304	1,101	1,031	HECH	Heat	
9	9	14	11	6	10	14	105	117	279	788	PTCH	Petroleum	
5,418	5,469	3,325	3,272	2,790	2,495	2,478	3,607	3,547	4,037	4,432	TTCH	Total	
329	334	256	233	147	125	70	106	191	245	259	CLNF	Coal	Non-Ferrous
444	447	205	207	182	179	163	177	259	264	256	ELNF	Electricity	Metal
181	178	140	137	108	106	27	42	126	129	252	GANF	Gas	
237	255	143	128	117	126	75	44	85	48	38	HENF	Heat	
33	35	16	18	17	19	3	3	23	22	23	PTNF	Petroleum	
1,224	1,249	760	724	571	555	338	372	684	708	828	TTNF	Total	
3,041	2,967	2,904	2,823	2,083	2,008	1,909	2,215	2,341	2,252	2,461	CLNM	Coal	Non-Metallic
320	334	318	319	262	247	241	260	267	303	312	ELNM	Electricity	Mineral
731	759	744	728	626	588	571	576	564	652	668	GANM	Gas	
903	902	573	519	426	414	364	87	33	78	72	HENM	Heat	
231	248	169	181	118	83	100	113	119	217	134	PTNM	Petroleum	
5,226	5,211	4,707	4,570	3,514	3,339	3,184	3,249	3,325	3,501	3,646	TTNM	Total	
		2	2	110	123	80	313	286	264	257	CLTE	Coal	Transport
		0	0	109	121	110	129	141	141	149	ELTE	Electricity	Equipment
		85	78	35	42	40	39	52	39	97	GATE	Gas	
		0	364	319	365	322	161	147	134	170	HETE	Heat	
		0	0	29	21	17	31	33	42	35	PTTE	Petroleum	
0	0	87	444	603	672	569	672	660	619	709	TTTE	Total	
453	435	1,112	1,016	635	533	440	801	727	612	709	CLMA	Coal	Machinery
795	809	785	738	478	379	355	345	322	395	372	ELMA	Electricity	
571	545	427	378	302	208	161	231	227	182	167	GAMA	Gas	
1,883	1,942	1,426	886	793	785	685	378	181	226	372	HEMA	Heat	
140	137	67	59	22	16	20	28	23	64	67	PTMA	Petroleum	
3,843	3,867	3,816	3,077	2,231	1,921	1,662	1,782	1,481	1,480	1,535	TTMA	Total	

Item	Energy	Year	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Mining and Quarrying	Coal	CLMN													
	Electricity	ELMN													
	Gas	GAMN													
	Heat	HEMN													
	Petroleum	PTMN													
	Total	TTMN	0	0	0	0	0	0	0	0	0	0	0	0	0
Food and Tobacco	Coal	CLFO	423	361	348	347	270	264	249	246	307	353	356	428	379
	Electricity	ELFO	183	200	221	235	242	247	269	264	256	234	282	292	273
	Gas	GAFO	0	0	39	0	0	0	0	43	33	34	38	44	35
	Heat	HEFO	1,509	1,580	1,655	1,720	1,782	1,819	1,853	1,808	1,858	1,830	1,656	1,726	1,855
	Petroleum	PTFO	234	251	302	310	311	350	389	466	307	378	363	470	432
	Total	TTFO	2,349	2,392	2,565	2,612	2,605	2,681	2,759	2,826	2,762	2,828	2,695	2,961	2,976
Paper/Pulp and Print	Coal	CLPA	7	7	7	8	8	9	6	7	11	9	7	8	4
	Electricity	ELPA	153	158	162	170	176	175	164	169	171	164	163	165	188
	Gas	GAPA	0	0	1	0	0	0	0	1	1	1	1	1	1
	Heat	HEPA	701	659	679	694	791	869	1,011	924	766	751	693	731	840
	Petroleum	PTPA	19	23	18	24	25	24	22	22	23	21	19	22	36
	Total	TTPA	880	846	866	896	1,000	1,078	1,203	1,123	972	947	884	927	1,069
Wood and Its Products	Coal	CLWO	7	8	9	14	17	18	15	16	13	19	18	15	15
	Electricity	ELWO	72	79	84	93	95	102	105	108	98	92	112	113	110
	Gas	GAWO	0	0	2	0	0	0	0	2	2	2	2	2	3
	Heat	HEWO	333	400	397	428	432	439	435	477	401	378	362	394	403
	Petroleum	PTWO	58	59	57	55	56	54	53	47	58	63	72	53	66
	Total	TTWO	469	546	550	591	600	613	608	649	573	553	567	577	598
Construction	Coal	CLCN	206	194	180	202	221	171	222	237	235	207	176	152	124
	Electricity	ELCN	89	102	133	146	164	186	197	219	197	197	209	221	226
	Gas	GACN	0	0	2	0	0	0	0	4	5	5	9	7	7
	Heat	HECN	345	397	451	546	590	604	531	478	474	546	579	636	624
	Petroleum	PTCN	305	317	381	456	461	531	531	543	534	546	555	567	524
	Total	TTCN	944	1,010	1,147	1,350	1,436	1,492	1,481	1,481	1,444	1,502	1,527	1,583	1,506
Textile and Leather	Coal	CLTX	28	27	30	23	28	30	31	31	27	24	27	35	18
	Electricity	ELTX	0	0	282	0	0	0	0	321	275	269	266	273	278
	Gas	GATX	0	0	3	0	0	0	0	4	4	5	4	5	5
	Heat	HETX	0	0	839	0	0	0	0	1,259	908	910	992	1,090	1,111
	Petroleum	PTTX	0	0	18	0	0	0	0	16	18	17	16	18	19
	Total	TTTX	28	27	1,171	23	28	30	31	1,630	1,232	1,224	1,305	1,420	1,432
Other Industry	Coal	CLOI	220	202	8	177	189	201	205	8	5	5	6	11	11
	Electricity	ELOI	1,069	1,256	25	1,566	1,818	1,691	1,665	36	36	46	33	35	35
	Gas	GAOI	1,346	1,329	24	2,189	1,839	1,551	1,641	28	28	26	25	25	26
	Heat	HEOI	2,799	2,993	167	3,302	3,535	3,892	4,354	343	170	167	174	151	162
	Petroleum	PTOI	401	494	34	644	662	675	630	40	40	35	32	28	42
	Total	TTOI	5,835	6,274	258	7,878	8,044	8,010	8,495	455	279	280	270	250	275

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996			
		220	188	123	109	178	398	240	328	230	CLMN	Coal	Mining
		324	304	265	261	283	286	198	226	211	ELMN	Electricity	and Quarrying
		74	73	45	31	63	83	67	66	48	GAMN	Gas	
		985	1,024	978	826	613	229	195	139	114	HEMN	Heat	
		64	54	41	39	68	56	34	61	92	PTMN	Petroleum	
0	0	1,667	1,643	1,452	1,265	1,205	1,052	734	819	694	TTMN	Total	
184	177	677	829	825	909	827	1,432	1,369	1,871	2,326	CLFO	Coal	Food
277	277	275	265	244	256	237	273	278	330	426	ELFO	Electricity	and Tobacco
22	24	47	46	48	47	55	76	172	92	363	GAFO	Gas	
1,930	1,921	1,560	1,379	1,179	1,120	981	679	464	143	137	HEFO	Heat	
439	465	94	76	68	59	55	111	109	248	234	PTFO	Petroleum	
2,852	2,864	2,653	2,595	2,363	2,393	2,156	2,570	2,390	2,684	3,485	TTFO	Total	
4	6	64	72	59	67	53	159	134	889	890	CLPA	Coal	Paper/Pulp
196	205	201	197	172	173	172	170	174	206	253	ELPA	Electricity	and Print
1	1	3	4	3	2	1	1	6	6	11	GAPA	Gas	
857	870	837	820	740	765	708	636	607	65	56	HEPA	Heat	
39	40	34	32	34	32	36	41	36	66	41	PTPA	Petroleum	
1,097	1,122	1,139	1,124	1,008	1,039	969	1,006	956	1,231	1,250	TTPA	Total	
10	7	158	139	107	116	110	214	190	328	463	CLWO	Coal	Wood and
123	122	120	119	109	85	87	94	123	82	111	ELWO	Electricity	Its Products
3	3	2	1	1	2	2	3	4	14	9	GAWO	Gas	
435	429	253	232	200	194	195	99	83	11	9	HEWO	Heat	
79	61	47	43	30	28	33	36	42	72	62	PTWO	Petroleum	
650	622	580	535	446	425	427	446	440	507	654	TTWO	Total	
70	66	292	246	175	140	92	202	188	76	190	CLCN	Coal	Construction
169	151	151	111	108	85	66	71	76	39	85	ELCN	Electricity	
2	3	5	5	4	3	3	7	52	54	19	GACN	Gas	
580	639	456	396	309	258	178	112	12	36	38	HBCN	Heat	
401	433	230	211	167	135	117	139	53	102	244	PTCN	Petroleum	
1,222	1,293	1,133	969	763	620	456	532	381	306	575	TTCN	Total	
7	3	309	263	211	201	163	480	313	520	640	CLTX	Coal	Textile and
272	273	259	243	189	140	132	139	153	158	155	ELTX	Electricity	Leather
6	3	4	4	3	3	4	7	13	7	175	GATX	Gas	
1,104	1,110	820	768	637	570	521	337	239	147	141	HETX	Heat	
19	19	4	4	4	4	4	11	13	68	24	PTTX	Petroleum	
1,408	1,408	1,397	1,282	1,043	919	824	973	731	900	1,134	TTTX	Total	
5	4	19	17	9	9	6	10	38	66	435	CLOI	Coal	Other Industry
35	35	9	9	5	5	2	2	5	12	168	ELOI	Electricity	
30	28	20	20	18	18	16	16	0	1	13	GAOI	Gas	
190	195	92	92	74	75	61	61	116	2	51	HEOI	Heat	
49	48	4	4	1	3	0	0	1	16	34	PTOI	Petroleum	
308	309	145	141	108	111	86	90	160	97	702	TTOI	Total	

Item	Energy	Year	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Transportation Sector	Coal	CLTR	4,001	3,644	3,434	3,173	3,038	2,546	2,532	2,405	1,993	2,030	1,859	1,704	1,462
	Electricity	ELTR	229	247	289	278	161	305	304	346	336	352	370	377	409
	Gas	GATR	0	0	0	0	0	0	0	0	0	0	0	0	0
	Heat	HETR	124	133	138	150	158	168	176	0	0	0	0	0	0
	Petroleum	PTTR	4,775	5,131	5,588	5,950	6,478	6,934	7,007	7,052	6,554	5,985	6,558	6,919	6,848
	Total	TTTR	9,130	9,155	9,449	9,552	9,835	9,953	10,019	9,804	8,883	8,367	8,788	9,000	8,719
Road	Petroleum	PTRO	4,775	5,131	5,588	5,950	6,478	6,934	7,007	7,052	6,554	5,985	6,558	6,919	6,848
	Total	TTRO	4,775	5,131	5,588	5,950	6,478	6,934	7,007	7,052	6,554	5,985	6,558	6,919	6,848
Railways	Coal	CLRA	448	396	359	274	214	226	157	104	152	77	94	68	49
	Electricity	ELRA	229	247	289	278	161	305	304	346	336	352	370	377	409
	Gas	GARA	0	0	0	0	0	0	0	0	0	0	0	0	0
	Petroleum	PTRA	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	TTRA	677	643	648	552	375	532	461	450	488	429	465	445	458
Air and Navigation	Coal	CLRT	3,553	3,248	3,075	2,899	2,824	2,320	2,375	2,301	1,841	1,953	1,765	1,636	1,414
	Electricity	ELRT	0	0	0	0	0	0	0	0	0	0	0	0	0
	Heat	HERT	124	133	138	150	158	168	176	0	0	0	0	0	0
	Petroleum	PTRT	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	TTRT	3,678	3,381	3,213	3,049	2,982	2,488	2,551	2,301	1,841	1,953	1,765	1,636	1,414
Other Sector	Coal	CLOT	18,354	19,189	20,837	22,800	22,189	23,279	22,993	24,156	23,430	25,454	22,731	22,588	24,009
	Electricity	ELOT	1,339	1,457	1,571	1,688	1,783	1,907	2,013	2,705	2,308	2,838	2,660	2,875	3,308
	Gas	GAOT	227	313	614	290	182	1,347	1,490	1,904	2,054	2,227	1,996	2,252	2,501
	Heat	HEOT	4,076	4,807	4,954	5,768	5,754	6,201	6,810	6,791	6,741	6,899	7,760	7,692	8,105
	Petroleum	PTOT	968	908	1,039	1,264	1,316	1,269	1,277	1,118	1,194	1,311	1,469	1,119	1,144
	Total	TTOT	24,963	26,674	29,015	31,809	31,225	34,002	34,583	36,675	35,728	38,728	36,616	36,525	39,066
Agriculture	Coal	CLAG	1,592	1,643	1,701	1,953	2,073	1,936	2,334	2,558	2,467	2,379	2,133	1,831	2,122
	Electricity	ELAG	174	204	112	279	321	363	384	156	166	168	174	174	187
	Gas	GAAG	0	0	21	0	0	0	0	6	6	6	6	6	8
	Heat	HEAG	477	517	530	595	635	696	692	620	589	599	650	702	696
	Petroleum	PTAG	683	729	799	993	1,090	1,073	1,051	944	1,027	1,122	1,298	978	965
	Total	TTAG	2,926	3,094	3,164	3,821	4,119	4,069	4,461	4,284	4,255	4,274	4,260	3,691	3,978
Commercial and Public	Coal	CLCM	2,672	2,636	3,310	3,519	3,288	3,508	3,633	0	1,338	195	1,175	1,153	846
	Electricity	ELCM	1,165	1,252	1,459	1,409	1,462	1,544	1,629	1,089	915	1,140	1,062	1,153	1,333
	Gas	GACM	0	0	0	0	0	0	0	0	0	0	0	0	0
	Heat	HECM	3,599	4,290	4,424	5,172	5,119	5,504	6,117	0	0	0	0	0	0
	Petroleum	PTCM	217	111	166	190	139	105	132	0	0	0	0	0	0
	Total	TTCM	7,652	8,289	9,359	10,289	10,009	10,661	11,512	1,089	2,253	1,334	2,237	2,306	2,179
Residential	Coal	CLRE	14,090	14,910	15,826	17,327	16,828	17,835	17,026	21,598	19,625	22,880	19,423	19,605	21,041
	Electricity	ELRE	0	0	0	0	0	0	0	1,461	1,228	1,529	1,425	1,547	1,788
	Gas	GARE	227	313	593	290	182	1,347	1,490	1,898	2,048	2,221	1,990	2,246	2,493
	Heat	HERE	0	0	0	0	0	0	0	6,171	6,153	6,300	7,110	6,989	7,409
	Petroleum	PTRE	68	68	74	81	86	91	95	174	167	189	172	141	179
	Total	TTRE	14,385	15,291	16,492	17,699	17,097	19,273	18,611	31,302	29,220	33,119	30,120	30,528	32,912
Non-Energy	Coal	CLNE	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gas	GANE	0	0	0	0	0	0	0	0	0	0	0	0	0
	Petroleum	PTNE	1,262	1,432	1,505	1,558	1,645	1,974	1,900	1,903	1,525	1,577	1,731	1,737	1,767
	Total	TTNE	1,262	1,432	1,505	1,558	1,645	1,974	1,900	1,903	1,525	1,577	1,731	1,737	1,767
CO <sub>2</sub> emission	CO2	97,041	101,970	107,095	114,909	119,825	125,709	131,454	133,325	122,007	122,394	124,350	131,933	135,748	
Year		1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	

(note) This table is based on the IEA's Energy Balance Table of Poland and the Polish Energy Data Center's Balance Table.

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996			
1,013	900	425	352	266	288	197	182	5	4	5	CLTR	Coal	Transportation
420	432	385	379	349	335	306	297	389	393	406	ELTR	Electricity	Sector
0	0	0	0	0	0	0	0	0	0	0	GATR	Gas	
0	0	561	520	435	373	331	197	0	0	0	HETR	Heat	
7,359	7,895	8,062	8,287	7,013	7,298	7,337	7,165	7,937	8,025	9,508	PTTR	Petroleum	
8,791	9,226	9,432	9,538	8,063	8,295	8,171	7,842	8,330	8,423	9,920	TTTR	Total	
7,359	7,895	7,245	7,398	6,451	6,814	6,744	6,620	7,079	7,141	8,843	PTRO	Petroleum	Road
7,359	7,895	7,245	7,398	6,451	6,814	6,744	6,620	7,079	7,141	8,843	TTRO	Total	
18	26	425	352	266	288	197	182	4	4	4	CLRA	Coal	Railways
420	432	385	379	349	335	306	297	389	393	406	ELRA	Electricity	
0	0	0	0	0	0	0	0	0	0	0	GARA	Gas	
0	0	432	395	327	260	213	197	293	281	238	PTRA	Petroleum	
438	457	1,241	1,126	941	884	716	677	685	678	649	TTRA	Total	
995	874	0	0	0	0	0	0	0	1	1	CLRT	Coal	Air and Navigation
0	0	0	0	0	0	0	0	0	0	0	ELRT	Electricity	
0	0	129	125	108	112	118	0	0	0	0	HERT	Heat	
0	0	384	493	236	224	379	348	565	603	427	PTRT	Petroleum	
995	874	513	618	344	336	497	348	566	604	428	TTRT	Total	
26,054	29,103	27,157	28,275	19,371	20,980	22,321	18,325	15,465	14,614	15,857	CLOT	Coal	Other Sector
3,262	3,319	3,341	3,439	3,741	3,643	3,615	3,671	3,548	3,697	3,657	ELOT	Electricity	
2,692	3,188	2,883	2,976	675	659	761	3,773	3,716	4,011	3,999	GAOT	Gas	
7,864	8,258	6,689	6,064	7,058	7,316	7,371	7,613	7,661	7,011	7,512	HEOT	Heat	
1,209	837	1,473	1,513	1,477	1,488	1,883	2,513	2,737	2,597	2,857	PTOT	Petroleum	
41,081	44,706	41,543	42,267	32,322	34,086	35,951	35,895	33,127	31,929	33,881	TTOT	Total	
1,837	1,633	2,773	2,942	2,792	2,354	1,804	1,783	1,998	2,018	2,258	CLAG	Coal	Agriculture
245	171	670	673	648	666	700	553	513	474	472	ELAG	Electricity	
7	2	10	9	9	6	1	3	5	6	10	GAAG	Gas	
753	766	299	260	209	205	153	53	2	10	38	HEAG	Heat	
1,053	662	1,375	1,412	1,456	1,458	1,829	2,267	2,483	2,262	2,386	PTAG	Petroleum	
3,894	3,234	5,126	5,295	5,114	4,690	4,487	4,659	5,000	4,770	5,166	TTAG	Total	
2,741	7,509	9,715	9,349	5,630	5,778	5,762	4,159	2,024	1,770	1,514	CLCM	Coal	Commercial and Public
1,288	1,344	1,140	1,160	1,326	1,214	1,263	1,551	1,470	1,669	1,532	ELCM	Electricity	
0	0	55	56	15	17	22	120	78	188	532	GACM	Gas	
0	0	0	0	0	0	0	1,154	1,268	623	1,001	HECM	Heat	
0	93	17	2	0	0	0	0	34	19	75	PTCM	Petroleum	
4,029	8,946	10,928	10,567	6,971	7,009	7,047	6,984	4,874	4,269	4,654	TTCM	Total	
21,476	19,961	14,669	15,985	10,948	12,847	14,755	12,383	11,443	10,826	12,085	CLRE	Coal	Residential
1,728	1,804	1,530	1,606	1,767	1,762	1,651	1,567	1,565	1,554	1,653	ELRE	Electricity	
2,685	3,187	2,818	2,911	652	637	738	3,650	3,633	3,817	3,457	GARE	Gas	
7,111	7,491	6,390	5,804	6,849	7,110	7,218	6,407	6,392	6,377	6,473	HERE	Heat	
157	83	82	99	22	30	54	246	220	315	396	PTRE	Petroleum	
33,158	32,525	25,489	26,405	20,236	22,387	24,417	24,252	23,253	22,890	24,062	TTRE	Total	
0	0	556	358	307	204	161	74	214	215	239	CLNE	Coal	Non-Energy
0	0	2,140	2,182	1,858	1,469	1,339	546	1,662	1,902	1,903	GANE	Gas	
1,971	1,826	2,913	2,811	2,062	1,691	1,800	281	1,652	1,506	1,740	PTNE	Petroleum	
1,971	1,826	5,609	5,351	4,227	3,364	3,299	901	3,528	3,623	3,882	TTNE	Total	
137,680	142,335	133,163	127,219	103,965	102,912	101,837	103,274	98,311	101,023	110,519	CO2		CO <sub>2</sub> emission
1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996			

## Appendix 9-3 Macro-economic Data for the Model

No	Variable	Mean	Source	Unit	1980	1981	1982	1983	1984	1985
<b>I GDE</b>										
<b>A Component (Current Price Base)</b>										
1	CP.N	Private Expenditure	I. T-3.3	PLN m	169					644
2	CG.N	Government Consumption	I. T-3.3	PLN m	23					96
3	IP.N	Private Investment	II. p.21	PLN m						
4	IG.N	Government Investment	II. p.21	PLN m						
5	I.N	Investment Total (IP.N + IG.N)	I. T-3.3	PLN m	66					289
6	J.N	Stock Change	I. T-3.3	PLN m	4					68
7	EXCL.N	Export Coal	VI	PLN m				14	19	22
8	EXOT.N	Export Others (EX.N - EXCL.N)	VI	PLN m						168
9	EX.N	Export Total	I. T-4.1	PLN m	71					190
10	MOG.N	Import, Oil & Gas	caluc.	PLN m				20	21	27
11	MOT.N	Import, Others	caluc.	PLN m				-20	-21	149
12	M.N	Import	I. T-4.1	PLN m	78					176
13	SD.N	Statistical Difference	II. p.19	%	-4					-66
14	GDE.N	Gross Domestic Expenditure	I. T3.3	PLN m	251					1,045
<b>B Component (Constant Price Base)</b>										
15	CP	Private Expenditure	I. T-3.4	PLN m	29,946	28,581	25,128	26,353	27,388	29,942
16	CG	Government Consumption	I. T-3.4	PLN m	9,662	9,223	9,447	9,740	10,474	11,111
17	IP	Private Investment	estimate	PLN m	10,262	7,979	7,706	8,122	8,638	8,960
18	IG	Government Investment	estimate	PLN m	7,681	6,217	5,367	5,839	6,412	6,741
19	I	Investment Total (IP + IG)	I. T-3.4	PLN m	17,943	14,196	13,073	13,960	15,050	15,700
20	J	Stock Change	I. T-3.4	PLN m						
21	EXCL	Export Coal	estimate	PLN m	1,018	497	933	1,153	1,408	1,186
22	EXOT	Export Others (EX - EXCL)	caluc.	PLN m	9,625	8,206	8,310	8,938	9,881	10,138
23	EX	Export Total	I. T-3.4	PLN m	10,643	8,703	9,243	10,091	11,288	11,323
24	MOG	Import Oil & Gas	estimate	PLN m	1,382	1,190	1,168	1,178	1,234	1,221
25	MOT	Import Others	caluc.	PLN m	10,923	8,688	7,386	7,876	8,672	9,380
26	M	Import	I. T-3.4	PLN m	12,305	9,878	8,554	9,054	9,907	10,601
27	SD	Statistical Difference	caluc.	PLN m	868	270	324	272	-26	-58
28	GDE	Gross Domestic Expenditure	I. T-3.4	PLN m	56,758	51,096	48,660	51,362	54,268	57,418
<b>II Prices</b>										
<b>A GDP Component Deflator</b>										
29	PC	Deflator of 'PC' (Current/Constant*100)	caluc.	1990=100	0.6					2.2
30	PCG	Deflator of 'IP' (same as above)	caluc.	1990=100	0.2					0.9
31	PIP	Deflator of 'CG' (same as above)	caluc.	1990=100						0.9
32	PIG	Deflator of 'IG' (same as above)	caluc.	1990=100						
33	PJ	Deflator of 'J' (same as above)	caluc.	1990=100						
34	PI	Deflator of 'I' (same as above)	caluc.	1990=100	0.4	0.0	0.0	0.0	0.0	1.8
35	PEXOL	Deflator of 'EXOL' (same as above)	caluc.	1990=100				1.2	1.4	1.9
36	PEXOT	Deflator of 'EXOT' (same as above)	caluc.	1990=100				1.2	1.4	1.9
37	PEX	Deflator of 'EX' (same as above)	caluc.	1990=100						1.7
38	PM	Deflator of 'M' (same as above)	caluc.	1990=100						1.7
39	PMOG	Deflator of 'MOG'	caluc.	1990=100	0.0	0.0	0.0	1.7	1.7	2.2
40	PMOT	Deflator of 'MOT'	caluc.	1990=100						1.6
41	PSD	Deflator of 'SD' (same as above)	caluc.	1990=100						1.7
42	P	Deflator of 'GDE' (same as above)	caluc.	1990=100						1.8
<b>B Others</b>										
43	CPI	Consumer Price Index	I. T-7.1a, 7.1b	1990=100	0.5	0.5	1.1	1.3	1.5	1.8
44	WPI	Wholesale Price Index	I. T-7.1a, 7.1b	1990=100	0.5	0.5	1.2	1.4	1.6	1.9
45	WI	Average wage Index of Employee		1990=100						2.2
46	W	Average wage			0.6	0.8	1.2	1.4	1.7	2.0
47	EXR1	Exchange Rate of Export based on BLPY	caluc.	1990=100						0.018
48	EXR2	Exchange Rate of Import based on BLPY	caluc.	1990=100						0.017
	EXR.wb	Exchange Rate based on World Bank								
49	INT	Interest, One-year-Term Investment Deposit Rate	II. p.66	%						

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Variable	No
											<b>GDE</b>	<b>I</b>
											<b>Component (Current Price Base)</b>	<b>A</b>
792	1,016	1,692	6,122	26,867	46,813	66,784	98,200	135,389	182,198	237,362	CP.N	1
118	152	243	707	10,808	19,520	28,960	31,834	39,462	50,962	62,325	CG.N	2
				7,774	6,890	8,860	10,590	14,890	20,850	29,520	IP.N	3
				6,577	9,990	11,290	14,120	18,970	26,290	44,563	IG.N	4
374	488	966	4,553	14,351	16,103	17,437	24,228	33,363	52,325	74,083	LN	5
91	106	299	2,618	2,590	328	-1,860	-520	-715	3,415	4,835	J.N	6
24	29	48	129	919	1,266	1,253	1,770	2,372	2,989	3,063	EXCL.N	7
212	333	627	2,128	15,132	17,759	25,989	33,963	48,210	68,357	81,543	EXOT.N	8
236	363	675	2,257	16,051	19,026	27,242	35,733	50,583	71,346	84,606	EX.N	9
32	38	60	140	1,285	2,442	2,918	3,526	4,089	4,986	6,979	MOG.N	10
186	284	533	1,621	10,765	18,138	22,561	30,689	44,300	65,820	91,516	MOT.N	11
217	322	593	1,761	12,050	20,579	25,479	34,215	48,389	70,806	98,495	M.N	12
-97	-109	-318	-2,664	-2,590	-328	1,860	520	715	-3,415	-4,835	SD.N	13
1,295	1,694	2,963	11,832	56,027	80,883	114,944	155,780	210,407	286,026	359,881	GDE.N	14
											<b>Component (Constant Price Base)</b>	<b>B</b>
31,489	32,123	33,135	33,040	26,867	28,572	29,233	31,044	32,218	33,667	37,034	CP	15
11,116	11,230	11,242	10,720	10,808	11,914	12,676	13,158	13,526	13,623	14,478	CG	16
9,363	9,371	10,291	11,213	7,774	5,905	5,392	6,084	6,647	7,874	9,575	IP	17
7,045	7,332	7,860	7,981	6,577	5,560	4,581	5,166	5,616	7,767	9,444	IG	18
16,408	16,704	18,151	19,194	14,351	11,465	9,974	11,250	12,263	15,641	19,020	I	19
	4,150	4,830	6,059	2,590	222	-1,531	-588	-665	322	392	J	20
1,125	1,015	1,055	946	919	682	633	754	918	1,045	1,071	EXCL	21
10,675	11,374	12,500	12,955	15,132	15,103	16,854	17,293	19,493	23,111	25,428	EXOT	22
11,800	12,389	13,555	13,901	16,051	15,786	17,487	18,047	20,411	24,156	26,500	EX	23
1,292	1,298	1,367	1,382	1,285	1,104	1,143	1,146	1,133	1,290	1,322	MOG	24
9,878	10,386	11,464	11,995	10,765	14,512	14,738	16,832	18,876	23,271	29,430	MOT	25
11,170	11,684	12,831	13,377	12,050	15,616	15,881	17,978	20,009	24,561	30,753	M	26
220	-4,150	-4,830	-6,159	-2,590	-222	1,531	588	665	-322	-392	SD	27
59,863	60,761	63,253	63,379	56,027	52,121	53,489	55,522	58,409	62,526	66,278	GDE	28
											<b>Prices</b>	<b>II</b>
											<b>GDP Component Deflator</b>	<b>A</b>
2.5	3.2	5.1	18.5	100.0	163.8	228.5	316.3	420.2	541.2	640.9	PC	29
1.1	1.3	2.2	6.6	100.0	163.8	228.5	241.9	291.7	374.1	430.5	PCG	30
					116.7	164.3	174.1	224.0	264.8	308.3	PIP	31
					179.7	246.4	273.3	337.8	338.5	471.9	PIG	32
	2.6	6.2	43.2	100.0	147.6	121.5	88.5	107.6	1,060.2	1,234.4	PJ	33
2.3	2.9	5.3	23.7	100.0	140.4	174.8	215.4	272.1	334.5	389.5	PI	34
2.1	2.9	4.5	13.7	100.0	185.7	197.9	234.8	258.6	286.0	286.0	PEXOL	35
2.1	2.9	5.0	16.4	100.0	117.6	154.2	196.4	247.3	295.8	320.7	PEXOT	36
2.0	2.9	5.0	16.2	100.0	120.5	155.8	198.0	247.8	295.4	319.3	PEX	37
2.0	2.8	4.6	13.2	100.0	131.8	160.4	190.3	241.8	288.3	320.3	PM	38
2.4	2.9	4.4	10.1	100.0	221.2	255.3	307.7	361.0	386.4	527.7	PMOG	39
1.9	2.7	4.7	13.5	100.0	125.0	153.1	182.3	234.7	282.8	311.0	PMOT	40
1.9	2.6	6.6	43.3	100.0	147.7	121.5	88.5	107.5	1,060.2	1,234.7	PSD	41
2.2	2.8	4.7	18.7	100.0	155.2	214.9	280.6	360.2	457.4	543.0	P	42
											<b>Others</b>	<b>B</b>
2.1	2.6	4.2	14.6	100.0	170.3	243.5	329.5	435.6	556.7	659.7	CPI	43
2.2	2.8	4.4	13.8	100.0	148.1	199.3	262.3	333.2	424.1	475.4	WPI	44
2.7	3.2	5.8	22.2	100.0	162.0	209.0	273.8	364.1	480.6	567.1	WI	45
2.4	2.9	5.3	20.7	103.0	175.6	243.9	320.2	425.5	560.6	661.5	W	46
0.019	0.029	0.049	0.175	0.992	1.455	1.946	2.630	2.984	3.119	3.465	EXR1	47
0.019	0.028	0.047	0.141	1.032	1.593	1.889	2.155	2.721	2.866	3.024	EXR2	48
				0.773	1.134	1.517	2.050	2.326	2.430	2.700	EXR.wb	
					67.3	52.0	38.1	31.1	25.9	21.1	INT	49



No	Variable	Mean	Source	Unit	1980	1981	1982	1983	1984	1985
<b>III Labor and Production</b>										
<b>A Labor</b>										
50	URATE	Unemployment Rate	II, p.29	%						
51	U	Number of Unemployment	II, p.29	persons th						
52	LN	Number of Employment	I, T-2.2a, 2.2b	persons th	17,325	17,420	16,996	16,951	16,998	17,144
53	LOT	Number of employers & Others	caluc.	persons th						
54	L	Number of workers	caluc.	persons th						
55	LA	Number of Active Population	II p.29	persons th	20,676	20,830	20,985	21,142	21,300	21,459
<b>B Production by Industries in Current Prices Value Added Term</b>										
56	VAG	Value Added by Agriculture	III.	PLN m						
57	VALIN	Value Added by Manufacturing Industry Total	IV, p.26-27	PLN m						
58	VALFO	Value Added by Food Industry	IV, p. 26-27	PLN m						
59	VALTX	Value Added by Textile Industry	IV, p.26-27	PLN m						
60	VALWO	Value Added by Wood and Timber Industry	IV, p.26-27	PLN m						
61	VALPA	Value Added by Paper/Pulp Industry	IV, p.26-27	PLN m						
62	VALCH	Value Added by Chemical Industry	IV, p. 26-27	PLN m						
63	VALNM	Value Added by Non Metal Industry	IV, p.26-27	PLN m						
64	VALPM	Value Added by Prime Metal Industry	IV, p.26-27	PLN m						
65	VALMN	Value Added by Machinery Industry	IV, p.26-27	PLN m						
66	VALOT	Value Added by Other Manufacturing Industry	IV, p.26-27	PLN m						
<b>C Production by Industries in Physical Term</b>										
67	STEEL	Crude Iron Production	III, p.389-396	tons th	11,953					9,807
68	CEMENT	Cement Production	III, p.389-396	tons th						15,000
69	PAPERP	Paper and Pulp Production	III, p.389-396	tons th						1,666
70	SUGAR	Sugar production	III, p.389-396	tons th						1,708
71	MEAT	Meat Production	III, p.389-396	tons th						1,973
72	FERTIL	Chemical Fertilizers	III, p.389-396	tons th						7,135
73	CHEMP	Other Petrochemical Products Production	III, p.389-396	tons th						14,067
74	VEHICLE	No. of Vehicles	III, p.389-396	units th						291
75	ALUM	Aluminum	III, same	tons th						47
76	LEAD	Lead	III, same	tons th						87
77	ZINC	Zinc	III, same	tons th						180
78	COPP	Copper	III, same	tons th						387
79	LIME	Limestone	III, same	tons M						12
80	SULPO	Sulphur Ore	III, same	tons th						2,887
81	SULP	Sulphur (100%, eg)	III, same	tons th						4,876
82	SALT	Salt	III, same	tons th						4,865
83	SHIPLN	Ship, Launched, Number	III, same	units						38
84	SHIPLT	Ship, Launched, DWT	III, same	tons th						409
85	SHIPSN	Ship, Settled, Number	III, same	units						41
86	SHIPST	Ship, Settled, DWT	III, same	tons th						343
87	MATLN	Machine Tools for Metal, No.	III, same	units th						57
88	MATLT	Machine Tools for Metal, Ton	III, same	tons th						42
89	WBOAD	Wood, Boards	III, same	m3 th						6,366
90	HBOAD	Wood, Hardboards	III, same	tons th						378
91	COTTON	Cotton and alike	III, same	km th						831
92	WOOL	Wool and alike	III, same	km th						105
93	SFIBR	Syntetic Fiber	III, same	km th						75
94	GLFT	Glass, Flat	III, same	tons th						
95	GLWA	Glassware	III, same	tons th						
96	BRICK	Brick	III, same	pcs m						
97	TRUCK	Truck	III, same	pcs th						
98	TRUCKT	Tractor	III, same	pcs th						
99	RVOIL	Refined Vegetable Oil	III, same	tons th						

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Variable	No
<b>Labor and Production</b>											III	
cc											Labor	A
				6.3	11.8	13.6	16.4	16.0	14.9	13.6	URATE	50
				1,126	2,156	2,509	2,889	2,838	2,629	2,415	U	51
17,193	17,138	17,023	17,002	16,280	15,326	14,677	14,330	14,475	14,735	15,139	LN	52
				467	789	1,263	397	425	280	203	LOT	53
				17,873	18,271	18,449	17,616	17,738	17,644	17,757	L	54
21,565	21,673	21,781	21,889	21,962	22,055	22,181	22,333	22,502	22,647	22,793	LA	55
<b>Production by Industries in Current Prices Value Added Term</b>												B
				3,938	4,598	6,146	8,898	11,211			VAG	56
						30,925	39,293	51,179			VALIN	57
						7,924	9,660	10,562			VALFO	58
						1,194	1,333	1,901			VALTX	59
						812	1,074	1,830			VALWO	60
						387	493	798			VALPA	61
						1,838	2,325	3,371			VALCH	62
						1,412	1,806	2,731			VALNM	63
						1,517	1,743	2,571			VALPM	64
						2,309	2,817	3,721			VALMN	65
						13,532	18,042	23,694			VALOT	66
<b>Production by Industries in Physical Term</b>												C
10,574	10,476	10,264	9,488	8,658	6,515	6,498	6,298	7,082	7,546		STEEL	67
15,800	16,100	17,000	17,100	12,500	12,000	11,900	12,200	13,800	13,900		CEMENT	68
1,714	1,782	1,843	1,746	1,447	1,458	1,598	1,667	1,843	2,006		PAPERP	69
1,753	1,671	1,684	1,710	1,971	1,636	1,468	1,982	1,383	1,595		SUGAR	70
2,259	2,233	2,248	1,995	1,628	1,394	1,255	1,093	1,090	1,145		MEAT	71
7,833	8,010	8,277	8,209	5,423	4,288	4,547	4,707	5,540	6,491		FERTIL	72
14,298	14,306	15,008	15,238	12,867	11,734	12,584	13,373	13,448	13,444		CHEMP	73
299	303	303	294	270	169	220	335	339	367		VEHICLE	74
48	48	48	48	46	46	44	47	50	56	52.1	ALUM	75
88	90	91	78	65	51	54	62	61	66	66.0	LEAD	76
179	177	179	164	132	126	135	149	158	166	165.0	ZINC	77
388	390	401	390	346	378	387	404	405	407	425.0	COPP	78
13	13	13	13	9	8	8	7	7	8		LIME	79
2,445	2,755	2,636	2,592	2,732	2,720	2,411	-	-			SULPO	80
4,894	4,966	5,000	4,864	4,660	3,935	2,917	1,893	2,163	2,427	1,769.0	SULP	81
5,419	6,175	6,179	4,670	4,055	3,840	3,887	3,817	4,079	4,214	4,163.0	SALT	82
37	40	41	34	39	28	26	23	23	29		SHIPLN	83
207	227	235	138	227	329	464	613	538	551		SHIPLT	84
42	41	35	35	35	25	30	26	28	33	37.0	SHIPSN	85
537	327	224	283	134	208	431	594	781	603	860.0	SHIPST	86
52	46	52	49	28	17	18	15	14	14	13.9	MATLN	87
39	39	40	37	32	18	11	10	9	10	10.4	MATLT	88
5,985	5,803	5,799	5,159	3,995	3,378	3,381	3,460	3,424	3,476	3,254.0	WBOAD	89
404	388	394	374	309	295	313	324	352	333		HBOAD	90
821	749	783	760	428	286	239	229	256	205	213.0	COTTON	91
103	100	101	97	65	44	33	32	33	33	32.0	WOOL	92
74	66	69	72	57	43	52	42	58	54		SFIBR	93
				345	323	308	295	266	327		GLFT	94
				577	592	565	624	712	777		GLWA	95
				1,234	1,051	1,083	1,119	1,121	1,131		BRICK	96
				39	21	18	19	21	31		TRUCK	97
				35	18	8	12	15	22		TRUCKT	98
				77	70	94	124	115	149		RVOIL	99

No	Variable	Mean	Source	Unit	1980	1981	1982	1983	1984	1985
<b>D Production Index</b>										
100	IIPSTEEL	Index of Production by Iron/Steel	IV, p.30-31	previous y.=100						
101	IIPCHEM	Index of Production by Chemical	IV, p.30-31	previous y.=100						
102	IIPNF	Index of Production by Non-Ferrous Metal		previous y.=100						
103	IIPNM	Index of Production by Non-Metallic Mineral	IV, p.30-31	previous y.=100						
104	IIPTE	Index of Production by Transportation Equipment	IV, p.30-31	previous y.=100						
105	IIPMC	Index of Production by Machinery	IV, p.30-31	previous y.=100						
106	IIPMQ	Index of Production by Mining and Quarrying	IV, p.30-31	previous y.=100						
107	IIPFD	Index of Production by Food	IV, p.30-31	previous y.=100						
108	IIPPP	Index of Production by Paper/Pulp	IV, p.30-31	previous y.=100						
109	IIPWO	Index of Production by Wood and Wood Products	IV, p.30-31	previous y.=100						
110	IIPCON	Index of Production by Construction		previous y.=100						
111	IIPTX	Index of Production by Textile	IV, p.30-31	previous y.=100						
112	IIPOT	Index of Production by Other Industry		previous y.=100						
113	IIP	Index of Total Industrial Production	IV, p.30-31	previous y.=100						
<b>IV Government Balance (Current Price Base)</b>										
<b>A Revenue</b>										
114	GRTAX	Revenue Source by Taxes	I, T-5.2a	PLN m						
115	GROTR	Revenue Sources by Others	caluc.	PLN m	0	0	0	0	0	0
116	GRT	Government Revenue Total	I, T-5.2a	PLN m						
<b>B Payment</b>										
117	GPCE	Payment for Current Expenses	I, T-5.1a	PLN m						
118	GPDE	Payment for Capital Expenditure	I, T-5.1a	PLN m						
119	GPT	Government Payment Total	I, T-5.1a	PLN m						
<b>C Net Financial Balance</b>										
120	GRPD	=Revenue - Payment	caluc.	PLN m						
<b>V Balance of Payment (USD Base)</b>										
<b>A Trade, Services, Transfer and Current Balance</b>										
121	DBLTR	Dollar Base, Balance of Trade	I, T-4.1	USD m	-1,636					402
122	DEXCL	Dollar Base, Export of Coal	caluc.	USD m						1,239
123	DEXORT	Dollar Base, Export of Other	estimate	USD m	14,170	0	0	0	0	9,446
124	DEX	Dollar Base, Export Total	I, T-4.1	USD m	14,170					10,685
125	DMOIL	Dollar Base, Import Oil	estimate	USD m						1,231
126	DMGAS	Dollar Base, Import Gas	estimate	USD m						353
127	DMOG	Dollar Base, Import Oil+Gas	estimate	USD m						1,584
128	DMOTR	Dollar Base, Import Others	caluc.	USD m	15,806					8,699
129	DM	Dollar Base, Import Total	I, T-4.1	USD m	15,806					10,283
130	DSERV	Dollar Base, Balance of Service (Net Balance)	I, T-4.1	USD m	-2,320					-2,390
131	DTRANS	Dollar Base, Balance of Transfer (Net Balance)	I, T-4.1	USD m	672					778
132	DBLCR	Dollar Base, Current Balance (TBLTR + DSERV +	I, T-4.1	USD m	-3,284	0	0	0	0	-1,210
<b>VI Money Supply (Asset and Liabilities of the Banking System)</b>										
<b>Liability</b>										
133	MLM2	Liability of Money + Quasi-money (Liquidity)	I, T-6.1	PLN m						
<b>VII Other Social Index</b>										
134	POP	Number of Population	III.	persons th	35,578	35,902	36,227	36,571	36,914	37,230
135	NHO	Number of Households	III.	units th						11,459
136	SPCCEN	Usable Dwelling Space, Central Heated	III.	1000 m2	135,693					171,053
137	ASPCHE	Adjusted Space Heating Area	estimate	1000 m3	187,442					245,281
138	CAR	Number of Car Population (registered)	III.	units th	2,383	2,321	2,862	3,182	3,396	3,671

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Variable	No	
											<b>Production Index</b>		<b>D</b>
											HPSTEEL	100	
											HPCHEM	101	
											IIPNF	102	
											IIPNM	103	
											IIPTE	104	
											IIPMC	105	
											IIPMO	106	
											IIPFD	107	
											IIPPP	108	
											IIPWO	109	
											IIPCON	110	
											IIPTX	111	
											IIPOT	112	
											IIP	113	
											<b>Government Balance (Current Price Base)</b>		<b>IV</b>
											<b>Revenue</b>		<b>A</b>
	533	989	2,492	16,680	18,022	27,293	41,345	56,457	74,750	90,090	GRTAX	114	
0	46	66	419	3,030	3,184	3,985	4,556	6,668	8,972	8,413	GROTR	115	
	579	1,054	2,911	19,710	21,206	31,278	45,901	63,125	83,722	98,503	GRT	116	
											<b>Payment</b>		<b>B</b>
	714	1,265	3,159	17,155	25,307	36,239	47,764	66,141	87,685	104,468	GPCE	117	
	94	158	407	2,164	1,629	1,950	2,478	2,725	3,484	4,194	GPDE	118	
	808	1,423	3,566	19,319	26,937	38,189	50,242	68,865	91,170	108,661	GPT	119	
											<b>Government Financial Balance</b>		<b>C</b>
	-229	-369	-655	392	-5,731	-6,911	-4,341	-5,740	-7,448	-10,159	GRPD	120	
											<b>Balance of Payment (USD Base)</b>		<b>V</b>
											<b>Trade, Services, Transfer and Current Balance</b>		<b>A</b>
	727	801	1,126	363	4,501	153	512	-2,293	-836	-1,827	-8,154	DBLTR	121
	1,248	996	984	739	926	870	644	673	795	959	884	DEXCL	122
	11,220	11,363	12,890	12,153	15,252	12,203	13,353	12,912	16,155	21,919	23,536	DEXORT	123
	12,468	12,359	13,874	12,892	16,178	13,073	13,997	13,585	16,950	22,878	24,420	DEX	124
	1,279	1,002	977	730	1,114	1,140	1,197	1,376	1,210	1,333	1,765	DMOIL	125
	427	352	312	263	131	392	348	261	293	406	543	DMGAS	126
	1,707	1,353	1,289	993	1,245	1,533	1,544	1,636	1,503	1,740	2,308	DMOG	127
	10,034	10,205	11,459	11,536	10,432	11,387	11,941	14,242	16,283	22,965	30,266	DMOTR	128
	11,741	11,558	12,748	12,529	11,677	12,920	13,485	15,878	17,786	24,705	32,574	DM	129
	-2,530	-2,765	-2,845	-3,243	-3,349	-2,599	-1,310	-940	-1,290	-478	-575	DSERV	130
	949	1,404	1,423	1,234	1,988	1,217	528	929	1,182	6	224	D'TRANS	131
	-854	-560	-296	-1,646	3,140	-1,229	-270	-2,304	-944	-2,299	-8,505	DBLCR	132
											<b>Money Supply (Asset and Liabilities of the Banking System)</b>		<b>VI</b>
											<b>Liability</b>		
	1,180	9,580	19,060	25,710	41,110	55,920	77,300	104,260	134,880		MLM2	133	
											<b>Other Social Index</b>		<b>VII</b>
	37,456	37,664	37,862	37,963	38,119	38,245	38,365	38,459	38,544	38,609	38,674	POP	134
	11,558	11,659	11,761	11,864	11,967	12,071	12,177	12,283	12,390	12,498	12,607	NHO	135
	176,937	183,024	189,320	195,832	202,603	216,850	226,434	226,142	227,535	229,049	244,395	SPCCEN	136
	255,119	265,369	276,051	287,184	298,836	321,862	341,302	345,259	347,005	351,530	377,492	ASPCHE	137
	3,970	4,218	4,543	4,846	5,261	6,112	6,505	6,771	7,153	7,517	7,900	CAR	138

No	Variable	Mean	Source	Unit	1980	1981	1982	1983	1984	1985
<b>VIII Energy Prices</b>										
139	PCLIN	Price of Coal for Industry, Average	estimate	PLN/ton						0.0
140	PGASO	Price of Gasoline	V.	PLN/L	0.002	0.002	0.003	0.004	0.005	0.01
141	PHOIN	Price of Heavy Oil for Industry	VI	PLN/ton						
142	PFOIN	Price of Fuel Oil, Industry, average	VI	PLN/ton						
143	PELE	Price of Electricity (Average)		PLN/kWh						
144	PELEH	Price of Electricity for Households	V.	PLN/kWh						0.000
145	PELEIN	Price of Electricity, Industry, average	estimate	PLN/MWh						
146	PELECM	Price of Electricity for Commercial Users		PLN/kWh						
147	PGAS	Price of Gas (Average)		PLN/M3						
148	PAGSH	Price of Gas for Households	V.	PLN/M3						0.000
149	PAGSCM	Price of Gas for Commercial Users		PLN/M3						
150	PGASIN	Price of Gas, Industry, average	VI	PLN/1000 M3						
151	PSTEAM	Price of Steam for Households	V.	PLN/M2						0.001
152	PSTEMIN	Price of Steam for Industry, average	VI	PLN/GJ						
153	PEXCLZ	Price of Coal Exported in PLN	estimate	PLN/Ton			0.38	0.44	0.61	
154	PEXCLD	Price of Coal Exported in US Dollar	estimate	USD/Ton						34.26
155	PIMOLZ	Price of Oil Imported in PLN	estimate	PLN/Ton			0.00	1.07	1.20	1.54
156	PIMOLD	Price of Oil Imported in US Dollar	estimate	USD/Ton						89.79
157	PIMGAZ	Price of Gas Imported in PLN	estimate	PLN/Ton				0.83	1.02	
158	PIMGAD	Price of Gas Imported in US Dollar	estimate	USD/Ton						59.85
159	K	Capital Stock	estimate	PLNm	171,089	143,830	136,164	144,884	155,737	163,032

(source)I: World Bank, "Poland. Country Economic Memorandum. Reform and Growth on the Road to EU," Report No. 16858-POL, July, 1997

II: IMF, "Republic of Poland - Recent Economic Developments," Feb. 21, 1997

III: GUS, "Statistical Year Book 1996(Rocznik Statystyczny 1996)," and numerous years

IV: GUS, "Statistical Year Book of Industry 1996 (Rocznik Statystyczny Przemyslu 1996)," and numerous years

V: GUS, "Price Changes at the National Economy in 1995 and Jan-Jun 1996 (Zmiany cen w gospodarce narodowej w 1995 i I polroczu 1996),"

VI: GUS, "Energy Statistics 1994-1995," and numerous years

(note) Figures in italic are estimated.

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Variable	No	
											Energy Prices	VIII	
0.0	0.00	0.01	0.10	10.43	43.7	59.1	61.8	104.1	130.1	123.3	PCLIN	139	
0.00	0.00	0.01	0.04	0.28	0.45	0.67	0.91	1.09	1.23	1.50	PGASO	140	
				85.5	138.4	118.4	286.3	243.4	662.5	807.9	PHOIN	141	
				222.1	359.2	505.6	765.5	879.9	1,029.9	1,256.0	PFOIN	142	
											PELE	143	
0.000	0.000	0.001	0.001	0.015	0.037	0.064	0.088	0.120	0.160	0.180	PELEH	144	
			0.9	1.4	14.1	46.8	30.2	46.4	80.0	152.4	115.5	PELEIN	145
			0.001	0.001	0.015	0.042	0.047	0.067	0.100	0.156	0.148	PELECM	146
											PGAS	147	
0.000	0.000	0.001	0.001	0.017	0.081	0.199	0.271	0.360	0.470	0.550	PAGSH	148	
											PAGASCM	149	
				29.9	140.0	262.6	194.6	250.0	566.1	662.5	PGASIN	150	
0.001	0.001	0.002	0.003	0.042	0.136	0.428	0.718	1.180	1.490	1.690	PSTEAM	151	
				1.80	5.83	3.62	9.13	12.73	16.80	19.06	PSTEMIN	152	
0.69	0.94	1.49	4.48	32.80	60.89	64.91	77.02	84.80	93.80	93.80	PEXCLZ	153	
36.37	32.17	30.59	25.62	33.06	41.84	33.35	29.28	28.42	30.08	27.07	PEXCLD	154	
1.68	1.97	3.04	6.85	88.41	158.69	189.62	216.81	258.77	294.89	294.89	PIMOLZ	155	
90.49	70.69	65.30	48.72	85.67	99.63	100.36	100.61	95.12	102.89	97.52	PIMOLD	156	
1.11	1.30	1.94	4.67	16.07	94.66	98.54	92.08	127.38	180.73	180.73	PIMGAZ	157	
59.86	46.71	41.61	33.23	15.57	59.43	52.15	42.73	46.82	63.06	59.77	PIMGAD	158	
170,608	174,804	186,690	191,213	172,306	168,663	172,140	183,561	196,129	227,934	218,822	K	159	