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## Energy and transition: the case of Bulgaria

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# Kiel Working Papers

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Energy and Transition:  
The Case of Bulgaria

by

Federico Foders, Ingrid Shikova et al.

April 1993



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## Preface

This report was prepared as part of a research project in the framework of the European Communities' (EC) Action for Cooperation in the Field of Economics (ACE). It represents the joint effort of researchers from several countries participating in a research network consisting of the Centre for European Studies, Sofia, Bulgaria, the University of Aberdeen, Aberdeen, United Kingdom, the Netherlands Economic Institute, Rotterdam, Netherlands, and the Kiel Institute of World Economics, Kiel, Germany (project coordinator). The heading of the ACE project was "Structural Change in the Bulgarian Energy Sector. Energy and Environmental Policy Options for Bulgaria and Opportunities for Cooperation with the EC." The following economists belonged to the team: Dr. Ludmilla Dudova, Dr. Ingrid Shikova, Dr. Marguerita Shivergeva, Dr. Georgi Tzekin (Sofia), Prof. Alexander Kemp (Aberdeen), Dr. Jan Hoogland (Rotterdam), and Dr. Federico Foders (Kiel).

The aim of the report is to analyse the Bulgarian energy sector and to derive sound policy options for a thorough energy reform in this country. In doing so, the study contributes to the policy-oriented economic analysis of the ongoing process of transformation of the Bulgarian economy and the role of this country in the international division of labour in the post-CMEA era.

This report would not have been possible without the strong support of Bulgarian government officials involved in the energy sector, who participated in many discussions and gave the research team access to hitherto unpublished data and other relevant information. Thanks are due particularly to the Committee of Energy. We are also indebted to the Committee of Geology and Mineral Resources, the Agency for Privatisation, the National Electricity Company, and Energoproekt.

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### Executive Summary

Bulgaria is a small, lower-middle-income country of Eastern Europe undergoing economic transition from central planning to a market economy. On both the macro and the microeconomic levels the country currently faces significant disequilibria. The energy sector is among the sectors of the Bulgarian economy which were worst hit by these developments. Bulgaria is scarcely endowed with energy resources and traditionally resorts to foreign trade in order to satisfy a major share of her demand for energy. As a member country of the former CMEA, the country pursued an energy-intensive strategy of industrialisation during the period 1946 - 1989 and became highly dependent on energy imports from mainly one source, the former USSR. The recent collapse of the CMEA and the rearrangement of the economic relations of the former USSR disrupted Bulgarian imports of primary energy, thereby creating serious shortages of fuels in the country.

Bulgaria makes use of a rather diversified basket of primary and final energy. The domestic conversion of primary into final energy is severely hampered by operational problems arising from both the use of deficient and obsolete equipment and shortages of fuel. Although nominal installed capacity for the production of electricity exceeds demand by far, power plants are unable to maintain high utilisation rates and to meet peak demand. In contrast to the supply side, the demand side of the energy market is biased towards oil products, which account for almost half of total energy consumption. Major consumers of energy are industry (particularly chemicals and iron and steel) and households. Furthermore, the low level of energy efficiency, the fuel mix and the high level of energy consumption have an adverse impact on the environment.

The current status of the energy sector can be associated with a policy that over a period of several decades favoured cheap energy and totally neglected investment in safety and environmental protection. Subsidised energy encouraged energy use and led to the emergence of an economic structure dominated by energy-intensive technologies. In addition, energy prices that did not reflect actual supply costs (domestic or inter-

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national) contributed to the accumulation of debt by the energy companies. Since the structure of consumer prices for energy favoured households, instead of big users, the former enjoyed the major benefits from energy policy.

Although one would have expected a highly centralised organisation of the energy sector for systemic reasons, Bulgaria's public institutions and companies involved in the sector are rather decentralised. There is neither an energy ministry nor any other ministry with the power to design, implement and monitor energy policy; rather, the responsibility for energy matters is widely scattered. This is probably the reason for the current lack of a coherent energy policy in Bulgaria. The instruments of energy policy, including regulated prices, taxes and tariffs, are not employed to achieve energy or environmental policy goals. Also, a consistent policy for the participation of foreign companies in the energy sector is not in sight. Moreover, existing plans to privatise government-owned companies do not yet extend to the energy sector. The same applies to the new legal-institutional framework which does not include laws governing production, transmission and consumption of energy.

Actions recommended in this report include (i) the design of a consistent energy strategy for Bulgaria, (ii) the centralisation of responsibility for energy policy, (iii) the creation of a comprehensive legal-institutional framework, and (iv) the privatisation of the energy sector. Energy policy should liberalise prices, tax consumption and pollution, and create incentives for a close cooperation with EC member countries. Given the close relationship between energy reform and the transformation process, to be effective, energy policy instruments call for an economic setting virtually free of major micro and macroeconomic disequilibria.

## I. Introduction

The governments of Central and Eastern Europe embarking on a transformation of their centrally-planned economies into market economies have already in an early stage been aware of the close interdependence between energy sector reforms and the general transformation process. Centralised decision-making on energy supply and allocation had been the cornerstone of central planning: abundant and cheap energy had been assumed to be the most important ingredient of economic growth after capital. Government investment in the energy sector had been given top priority. This growth policy resulted in an economy with both high energy and high capital intensities. With such a legacy of the past, energy sector reform can be said to constitute a necessary condition in the transition from a centrally-planned to a market economy.

Decades of cheap energy have led to a series of domestic and regional distortions. Besides an energy-intensive industrial structure, domestic distortions include a lack of investment in energy-saving technologies, in the development of alternative (depletable and non-depletable) fuels, and in environmental protection (including nuclear safety). On a regional level, the dependency of the former CMEA member countries regarding energy imports from mainly one source, the former USSR, developed into a serious threat for sustained energy-intensive economic growth in those countries. The mounting gap between regional energy supply and consumption contributed to the exhaustion of this resource-wasting model of growth in the 1980s; the systemic limits to the supply of conventional fuels could not be effectively compensated for by turning to the nuclear option. Since the CMEA member countries exchanged an important part of their national product for energy (and other) imports from the former USSR, the scope for a regional diversification of energy imports - which would have called for a diversification of exports towards hard currency regions - was generally very small.

With the CMEA dissolved at the turn of the decade, the burden of adjustment in the energy sector had to be borne since then not by the Russian Federation and some other energy-rich CIS member states, but primarily

by the energy-poor, former CMEA member countries. Not surprisingly, energy sector reform has been put high on the economic policy agenda for the 1990s in the energy-importing countries of Central and Eastern Europe. However, since the degree of distortion, the fuel mix, the economic structure and the status of the transformation process differ substantially across countries, the exact design and sequencing of the policy and instruments needed in the framework of a thorough energy reform should be tailored to the very specific conditions prevailing in each country. This study sets out to analyse the Bulgarian case, in an attempt to derive sound policy proposals for a country severely hit by the rearrangement of regional energy trade by the former USSR.

A word on the quality and availability of Bulgarian economic statistics should be in order here. While official Bulgarian statistics for the 1970s and 1980s are generally unreliable, recent statistics are, in part, not available, following the reorganisation of the Central Statistical Office. In this study we therefore draw heavily on such sources as unpublished reports prepared by the World Bank, PlanEcon's Reports on Developments in the Economies of the Soviet Union and Eastern Europe, and the US Central Intelligence Agency's Handbook of Economic Statistics, as far as general statistics are concerned. In those cases in which estimates from alternative sources differ we offer our own estimates. In contrast to general economic statistics, energy sector statistics from Bulgarian sources, in particular from the Bulgarian Committee of Energy, seem to reflect actual developments in the energy field; remaining gaps were filled in this report resorting to PlanEcon's Quarterly Energy Report, a recent unpublished sector study by the World Bank and other published material.

## II. Economic Background and Outlook

### 1. Growth Performance

According to standard economic indicators, Bulgaria is currently experiencing a deep recession. Industrial production in the first four

months of 1992 fell by about 20 per cent compared to the same period of 1991 and by about 55 per cent as compared to 1990. On average, consumer prices increased by some 5 per cent per month during the period April 1991 - April 1992; at the end of April 1992, almost half a million persons were unemployed (12 per cent of the labour force) (PlanEcon Report 1992). Due to recession-cum-inflation, Bulgaria's per capita income is expected to face a dramatic drop in 1992. Following the World Bank's classification, Bulgaria belongs to the group of countries with a lower-middle income, specifically to the subgroup with a per capita income estimate for 1990 in the range of US \$ 2060 (Algeria) and US \$ 2370 (Argentina); the estimate for Bulgaria is US \$ 2250, which is higher than Poland's (US \$ 1690) and Romania's (US \$ 1640) and amounts to no more than 10 per cent of the per capita income of the US at current exchange rates (World Bank 1992 b).

The deterioration of Bulgaria's economic performance is not a recent phenomenon. During the 44 years of communist rule (1946 - 1989) this formerly agricultural country showed a fast pace of industrialisation and, at first, achieved average rates of annual growth of real GDP of almost 6 per cent per year in the 1950s and 1960s. Thereafter, however, growth slowed down to half this rate in the 1970s and to less than 1 per cent per year in the 1980s (Table 1). Thus, the current recession cannot be blamed on either the domestic transformation process or the disintegration of the CMEA alone. Since economic growth was driven primarily by an expansion of industry, particularly of heavy industry, plausible hypotheses explaining Bulgaria's adverse development after 1970 are that import substitution in Bulgaria had already reached its limits in the late 1960s, and that neither the existing division of labour within the CMEA nor the rate and quality of technical progress achieved in the USSR (the region's technological leader) offered new possibilities for industrial growth in Bulgaria. As a small, resource-poor country with a population of 8.8 million, exports constituted a necessary outlet for Bulgaria's industry. Continued export expansion was constrained on the one hand by a diminished absorption capacity of CMEA member countries for Bulgarian exports, due to the fact that this country had begun to run an increasing trade surplus with CMEA member countries in the 1980s. On the

Table 1 - Real Gross Domestic Product Growth in Central and Eastern Europe 1961-1991 (per cent)

Country	1961-70 <sup>a</sup>	1971-80 <sup>a</sup>	1981-89 <sup>a</sup>	1990 <sup>b</sup>	1991 <sup>b</sup>
Bulgaria	5.8	2.8	0.8	-11.8	-26.4
Czechoslovakia	2.9	2.8	1.4	-2.9	-16.0
Hungary	3.4	2.6	0.8	-5.7	-6.5
Poland	4.2	3.6	0.5	-8.9	-7.0
Romania	5.2	5.3	-0.1	-10.8	-12.2
Average <sup>c</sup>	4.3	3.4	0.7	-8.0	-13.6

<sup>a</sup> Average annual rates; - <sup>b</sup> annual changes; - <sup>c</sup> unweighted.

Source: 1961-80: Central Intelligence Agency [1990]; - 1981-91 (excl. Bulgaria 1990/91): PlanEcon Report [1991, 1992]; - Bulgaria 1990, 1991: World Bank [1992a].

other hand, an increasing deficit with Western countries indicated that Bulgarian products were losing competitiveness in the West. All in all, external limits to a further expansion of domestic industrial production along traditional lines seem to have contributed to the slowdown in economic growth. For systemic reasons, this development could not have been halted and reversed by policies encouraging domestic structural change and pointing towards a way out from the Soviet technology trap. The disintegration of the CMEA only worsened the situation.

A glance at the growth performance of Central and Eastern European countries (Table 1) reveals that in recent decades Bulgaria not only experienced rates which were much lower than her own historical record, but also lower than the rates achieved by other countries in the region. Having lead regional economic growth in the 1960s, Bulgaria suffered the severest slowdown thereafter as well as a contraction of real GDP in 1990 and 1991 that has hitherto gone unmatched in the region.

## 2. The Structure of the Bulgarian Economy

Before World War II, agriculture was Bulgaria's main economic activity,

providing almost 65 per cent of total output. The country's comparative advantage was founded on its continental climate and fertile soil. Industry provided only 15 per cent of total output. As can be seen from Table 2, the importance of both sectors almost reversed between 1939 and 1990. Interestingly, agriculture reached its lowest share in 1989 and started to recover again immediately after the transformation process was initiated. The share of industry increased continuously until 1987 and declined thereafter. Thus, Bulgaria's economic structure resembles quite well the pattern observed in other former CMEA member countries, in which a disproportionately big industrial sector dominates the economy. Compared to other lower-middle-income countries, as Algeria, Malaysia and Argentina, which, as Bulgaria, pursued an industrialisation strategy based on a forced reallocation of production factors away from agriculture towards industry, Bulgaria's industrial sector also seems to be oversized. On the other hand, Bulgaria's services sector appears to be much smaller than the one typical for a lower-middle-income market economy.

Table 2 - Economic Structure of Bulgaria<sup>a</sup> 1939 - 1990

Year	Agriculture <sup>b</sup>	Industry <sup>c</sup>	Construction	Transport <sup>d</sup>	Trade	Other
1939	65.0	15.0	5.0 <sup>e</sup>	4.0 <sup>e</sup>	10.8 <sup>e</sup>	3.0 <sup>e</sup>
1965	29.0	49.0	8.0	4.0	8.0	2.0
1980	19.0	51.0	9.0	8.0	10.0	3.0
1985	13.3	59.9	9.9	7.6	6.9	2.4
1987	12.6	60.6	9.6	7.6	7.5	2.1
1988	12.1	60.4	9.8	8.3	7.3	2.1
1989	11.5	58.9	9.8	8.9	8.7	2.2
1990	14.2	56.8	9.1	9.1	9.0	1.8

<sup>a</sup>Contribution to the Net Material Product; - <sup>b</sup>includes forestry; - <sup>c</sup>includes mining and energy; - <sup>d</sup>includes communications; - <sup>e</sup>own estimates.

Source: Economist Intelligence Unit (b) [1991]; - Economist Intelligence Unit (a) [1992]; - own estimates.



Bulgaria's industry structure is heavily biased towards basic, material-intensive industries, as chemicals and petrochemicals, metallurgy, machine building and electrical engineering (Table A1), another systemic heritage. This notwithstanding, food processing still contributes about a quarter of total industrial output - much more than in any other former CMEA member country. In this respect, Bulgaria's economy is very similar to other lower-middle-income countries. Another systemic feature influencing the structure of manufacturing is the relatively unimportant production of durable consumer goods and of capital goods for the production of durable consumer goods in this country.

Imbalances in the economic structure can also be observed in the geographical pattern of production. Industrial plants are generally concentrated in urban areas, where the centralised administration of economic activity took place. Migration from the countryside to the cities in the wake of the already mentioned discrimination against agriculture was a necessary component of Bulgaria's model of industrial development. Excessive geographic concentration of material-intensive production lead to negative externalities in terms of environmental damage and a wasteful use of the country's very limited water resources.

### 3. The Pattern of Foreign Trade

Foreign trade plays a key role in the Bulgarian economy. Current estimates put exports plus imports as a share of Bulgaria's GDP somewhere between 42 and 97 per cent in 1990/1991 (Table 3), with the lower figure already implying a relatively high degree of openness. Other lower-middle-income countries as, for example, Algeria and Argentina present shares of 50 and 22 per cent, respectively (World Bank 1992b). Although data from different sources differ, the general impression is that total Bulgarian trade and particularly ruble-denominated transactions dropped sharply in 1991 (Table 3), as a consequence of the disintegration of the CMEA. However, the reduction in trade value seems to be related not only to a decrease in the physical volume of trade, but also to such factors as (i) the valuation of ruble trade in US dollars, (ii) the depreciation of the Bulgarian currency vis-a-vis the US \$ between January 1990 (leva

Table 3 - Bulgarian Foreign Trade by Currency Areas 1990, 1991 (Estimates)

Trade/Indicators	1990		1991	
	Customs Statist.	Payments Statist.	Customs Statist.	Payments Statist.
Exports (Millions of US \$)	8 514	8 458	3 433	4 366
- Convertible Currency	2 627	2 615	2 734	3 737
-- former CMEA	NA	NA	1 349	1 352
-- West	2 627	2 615	1 385	2 385
- Ruble	5 887	5 843	699	629
Imports (Millions of US \$)	10 491	10 798	2 700	4 114
- Convertible Currency	3 101	3 372	2 330	3 781
-- former CMEA	NA	NA	1 040	1 302
-- West	3 101	3 372	1 290	2 479
- Ruble	7 390	7 426	370	333
Trade Indicators <sup>a</sup> (per cent)				
Exports/GDP	43	43	24	30
Imports/GDP	53	55	19	28
(Exports + Imports)/GDP	96	97	42	58
<sup>a</sup> Assumptions: GDP for 1990 estimated at US \$ 19800 Million and for 1991 at US \$ 14573 Million (decrease of 26.4 per cent).				

Source: Trade statistics: PlanEcon Report [1992]; GDP estimate for 1990: World Bank [1992a]; own estimates and calculations.

2.02/US \$) and December 1991 (leva 17.51/US \$), and (iii) the development of cross rates (leva-ruble-dollar) during this period. Also, price changes for tradables in the ruble area should have had an impact. Although at this stage it is neither possible to clearly identify the nature of all the relevant factors nor to determine the actual weight of individual factors, their combined effect on Bulgarian foreign trade can be readily seen from Table 3: as measured by balance of payments statistics, exports fell by 48 per cent and imports by 62 per cent; customs statistics indicate still higher decreases.

In contrast to total and to intra-CMEA trade, Bulgarian exports to and imports from the West decreased by only 9 and 25 per cent, respectively (payments statistics), a development which almost doubled the share of trade (exports plus imports) with the West in total Bulgarian foreign trade. Nevertheless, the former CMEA member countries remained Bulgaria's largest destination and origin of Bulgarian trade flows in 1991, with the former Soviet Union remaining the largest single trade partner (Table A 2). While the relative shares of both exports to and imports from EFTA member countries and the US also increased, the share of trade with EC member countries increased most, particularly the shares of trade with Italy, Greece and the United Kingdom; Germany still was Bulgaria's single largest partner in the EC. The relative share of trade with LDCs also benefited from the breakdown of intra-CMEA trade.

The shifts in the regional structure of Bulgarian's foreign trade that occurred in 1990/1991 were related to shifts in the commodity structure of this country's foreign trade. Machinery and equipment, once the dominating product group in both total exports and imports, were displaced by resource-based product groups as chemicals and fertilizers, food raw materials, processed foodstuffs, and industrial consumer goods<sup>1</sup> (Table A 3). Fuels, minerals and metals, formerly (1990) amounting to "only" about 34 per cent of total imports, accounted for about 59 per cent of total imports in 1991, due largely to the valuation of fuels at international prices.

Recent developments in the direction and composition of Bulgarian foreign trade were accompanied by a radical change in trade policy. Whilst in the past this country relied on state trading through a few government-owned trade firms and substantial quantitative restrictions, most trade barriers were abolished in February 1991. Import licences are now granted automatically virtually for all goods (except weapons and a few other defence-related goods) and export restrictions are retained only for a small number of items. Export taxes and import duties have been eliminated. Trade rights have been extended to all firms, private and

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<sup>1</sup> Cotton products, carpets, overcoats, men's suits, woman's dresses, leather shoes, medicines.

non-private, and all importers enjoy unlimited access to foreign exchange in the wake of the introduction of current account convertibility of the domestic currency. Exporters are required to repatriate their proceedings within a month; they are allowed to keep foreign currency-denominated accounts in Bulgaria.

Even if the relative share of Bulgarian trade with the OECD member countries and LDCs seems to have benefited from the collapse of the CMEA, it should be noted that Bulgaria has been running a mounting deficit in its convertible-currency current account and that therefore genuine trade creation and expansion with the West will be limited by Bulgaria's ability to cope with the payments problems associated with this country's foreign debt. Private capital inflows are still negligible and foreign exchange earnings continued to drop in spite of substantial hard-currency income from tourism in the wake of the Yugoslav crisis. At the end of 1991, Bulgaria had accumulated a total debt of US \$ 11375 Million, around 79 per cent of GDP (estimated at US \$ 14573 Million) and 304 per cent of the country's convertible-currency exports as shown in Table 3. Compared to the external debt picture presented in 1990 (Table A 4), the debt burden increased dramatically in 1991, bringing Bulgaria on a par with Hungary, Poland and Argentina in this respect. The size of the debt is related to the fact that Bulgaria financed her growing deficit in the convertible-currency current account in the 1980s (especially since the mid-1980s) primarily with credits with short maturities from Western commercial banks and now has to face an extraordinary debt service burden. Although the Bulgarian government suspended debt service in March 1990, ongoing negotiations with the London Club of commercial bank creditors could help to restore Bulgaria's access to the international capital markets soon.<sup>1</sup> In September 1992 Bulgaria resumed interest payments and some weeks later the Parliament ratified the debt rescheduling agreements negotiated with six of the 14 Paris Club creditor governments.

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<sup>1</sup> Issues discussed in London include (i) a partial write-off of debt, (ii) permission for Bulgaria to buy back her debt in the secondary market, and (iii) a debt-equity swap programme [PlanEcon Business Report, 14 October 1992].

#### 4. Economic Policy

Bulgaria experienced her "Big Bang" in early 1991, when prices for all goods excluding basic food products and energy were liberalised. Energy prices were raised twice during 1991, albeit without entirely closing the gap between domestic prices on the one hand and domestic production costs and world market prices on the other. The prices for coal, district heating and electricity for households, however, remain heavily subsidised. The prices for seven out of the 14 goods classified as essential and formerly administered by the government were liberalised in May 1992. The big bang brought about a shift in the consumer price index as well as real wage losses during the first three months (Table 4). Although the central bank largely accommodated the price increase by expanding the money supply in February, the money supply contracted in March. With the real rate of interest being negative, the supply of money (as measured by M1) continued to expand in the following months in a climate of general recession. The immediate effects were an improvement of the real wage - in spite of further price increases of controlled products - and higher government spending, with the latter paving the way for higher rates of inflation. The system of multiple exchange rates was substituted by a unified rate, floating vis-a-vis all other currencies, and partial internal convertibility. Given that the real exchange rate appreciated almost every month from March 1991 to May 1992, contributing to an overvaluation of the domestic currency (Table 4), the floating can be assumed to have been of the managed type, aiming at keeping the import bill and foreign debt service payments in domestic currency as low as possible. A reduction of the budget deficit (1990: 9.2 per cent of GDP) was originally planned for the end of 1991. Unfortunately, due to the serious decline in economic activity experienced in 1990/1991 fiscal revenues were much lower than expected, so that the deficit remained at some 7 per cent, albeit improving somewhat towards the end of the year (World Bank 1992a); interest payments accounted for about a third of government expenditure in 1991.<sup>1</sup>

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<sup>1</sup> The OECD estimates a budget deficit of 12.7 and 14.8 per cent of GDP for 1990 and 1991, respectively [OECD 1992, p. 16].

Table 4 - Bulgaria: Monetary Indicators January 1991-May 1992

	CPI <sup>a</sup>		Real Wage <sup>b</sup>		M1 <sup>c</sup>		Exchange Rate <sup>d</sup>			
							Nominal		Real	
	Index Changes <sup>e</sup>		Index Changes <sup>e</sup>		Index Changes <sup>e</sup>		Index Changes <sup>e</sup>		Index Changes <sup>e</sup>	
1991										
January	187.6	12	74.8	-30	100.5	0	140.1	0	78.9	-12
February	418.0	81	49.4	-41	184.1	61	674.3	157	170.7	77
March	629.2	40	32.8	-41	155.5	-17	841.1	22	141.7	-19
April	644.9	3	38.4	16	173.5	11	839.6	0	138.3	-2
May	650.0	1	41.9	9	176.7	1	915.3	9	149.8	8
June	688.3	5	43.2	3	171.8	-2	896.0	-2	139.0	-8
July	746.1	8	43.2	0	190.8	10	835.6	-7	119.7	-15
August	802.1	8	42.2	-3	186.3	-2	925.2	10	123.8	4
September	832.6	3	51.6	20	196.9	5	879.2	-5	113.7	-9
October	860.0	4	53.8	5	220.9	12	898.0	2	112.7	-1
November	909.9	5	60.4	11	218.0	-2	860.4	-4	102.3	-9
December	947.2	4	64.5	7	220.0	1	866.8	0	99.1	-3
1992										
January	992.6	5	55.1	-16	NA	NA	876.2	2	95.7	-4
February	1050.2	6	NA	NA	NA	NA	898.5	2	93.1	-3
March	1099.6	4	NA	NA	NA	NA	920.3	2	91.6	-1
April	1134.7	3	NA	NA	NA	NA	908.4	-1	87.8	-4
May	1202.8	6	NA	NA	NA	NA	916.5	1	83.9	-5

<sup>a</sup>Retail price index (January 1990 = 100); <sup>b</sup>Nominal wage deflated with the CPI (January 1990 = 100); <sup>c</sup>Nominal narrow money measure (January 1990 = 100); <sup>d</sup>Leva per US \$ (January 1990 = 100); <sup>e</sup>log-changes; <sup>f</sup>(nominal rate/CPI Bulgaria). CPI USA.

Source: Own calculations with data from PlanEcon Report [May 1992].

The government progressed in transforming the Bulgarian economy into a market economy. As part of a financial reform, it created the institutional requirements for a two-tiered banking system and legally separated the central bank from the government. Restitution and privatisation legislation has been finally adopted - Bulgaria is the last of Eastern European countries to privatise -, and the government has already set up an agency similar to the German "Treuhand" to administer

privatisation projects. In many aspects, the privatisation law resembles the ones passed in Hungary and Poland, which is to say that the voucher or mass privatisation option has definitively been rejected. The new constitution endorses private property and the new company law offers a wide array of organisational possibilities for private economic activities. Other important laws (taxation, securities, bankruptcy, intellectual property, etc.) are currently being prepared. However, until now, about 90 per cent of the economy is still run by the state, although the World Bank reports that more than 170000 new firms were registered in 1991 and that the government is rapidly removing most of the remaining formal constraints on the establishment of new private firms [World Bank 1992a].

Small scale privatisation began in 1991 and affected some 70 shops and petrol stations. Also, restitution of agricultural land was launched during this year. 1992 saw a new drive in privatisation and restitution in urban areas with a new general law and amendments to older laws being passed. The new law governs not only small but also large scale privatisation, concerning the auctioning of enterprises with a book value of 10 to 200 Million leva (about US \$ 0.5 to 10 Million) by the privatisation agency. All enterprises have to be valued first by chartered accountants; employees may buy up to 20 per cent of non-voting shares at a discount. The agency is responsible for the privatisation of 8000 major firms, while small and middle-sized firms are being privatised directly by the ministries. The Ministry of Industry intends to offer between 80 and 100 enterprises for sale, which have been grouped in three classes according to their readiness for privatisation.<sup>1</sup> The agency aims at attracting mainly foreign buyers, but subsidised credit shall be available for potential domestic buyers. Several problems, however, remain unsolved. Old enterprise debt (government debt and interfirm debts) still needs to be dealt with. The privatisation scheme foreseen seems to be

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<sup>1</sup> A firm complies with Bulgarian privatisation rules if it has a complete ownership documentation and a relatively "good" financial situation (= fixed assets exceed liabilities). Firms that have to undergo restructuring belong to the second class, whereas firms that are to be liquidated make up the third class [PlanEcon, Business Report, 17 February 1993, p. 8].

geared toward foreign capital; there still is no local capital market to mobilise domestic savings on any important scale. Also, since major firms are being transformed into public stock companies, a stock market in which the actual economic value of these firms can be determined is still absent. In the end, the general investment climate as well as the availability of attractive debt-equity swap schemes will determine the level and pace of foreign involvement. Hitherto at least, foreign direct investment in Bulgaria has been rather negligible.

Demonopolisation is also underway in the context of economic restructuring. Large industrial conglomerates as well as large construction, transport, tourism and trade firms were broken up into smaller independent units. These smaller units were then transformed into joint-stock and limited liability companies; share ownership is retained by the government until privatisation takes place. The same procedure is applied in agro-industry. In some of the cases in which demonopolisation was impossible and the affected firms could not be liquidated, the soft budget constraint was continued. In other cases, however, state subsidies, government credit and the wage bills were put under tight control. Enterprise debt, firm asset valuation and the liquidation of unprofitable firms are issues still to be addressed more seriously in the current phase of the transformation process, as well as alternative privatisation schemes and the establishment of a local capital market in order to mobilise domestic savings [OECD 1992].

## 5. Outlook

Three major elements are very likely to determine Bulgaria's economic future: (i) the speed of the transformation process and the quality of its results, (ii) Bulgaria's international position and (iii) the international environment. The present status of the transformation process has already been analysed in the preceding section; here we will focus on (ii) and (iii).

Bulgaria's international position can be established with respect to this country's relative growth (or catching-up) potential and with re-



spect to this country's international competitiveness in hard-currency trade. Vis-a-vis the United States, the technological leader of the West, the catching-up potential of Bulgaria seems to be similar to the one shown by other Eastern European countries and by other lower-middle-income countries as well. As can be inferred from Table A 5, comparing GDPs across countries with purchase power parities (base year: 1985) instead of current exchange rates, in 1990 Bulgaria's per capita income exceeded Hungary's, Poland's, Romania's, Algeria's and Argentina's. If one is ready to follow the catching-up hypothesis,<sup>1</sup> the speed with which a country converges to the income level of the US could be higher for the latter countries than for Bulgaria.

The international competitiveness of Bulgaria can be inferred from the indicator of revealed comparative advantage (RCA), as shown in Table A 6. This indicator shows whether a country is competitive (RCA positive) or not (RCA negative) in international trade with respect to a specific product group. According to the estimates in Table A 6, Bulgaria has demonstrated to be competitive in her trade with OECD member countries in raw-material-intensive products (1970, 1980, 1988), in labour-intensive products and in capital-intensive products (both only in 1988). Vis-a-vis OECD member countries, Bulgaria's comparative disadvantage showed up in R&D-intensive products. This can be interpreted as meaning that as a result of the heavy systemic distortions in the Bulgarian economy from 1946 to 1988, following the factor proportions hypothesis of international trade, the relatively (artificially) abundant factors determined Bulgaria's international position. Since abundance and scarcity are economic concepts and depend on the correct valuation of physical quantities, the transformation process can be expected to radically change the measured abundance and scarcity of production factors by changing their value. Changes in the relative factor supplies are likely to result in a new international position. Bulgaria's future position could be influenced by the fact that at international prices

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<sup>1</sup> Expressed in simple terms, the hypothesis maintains that, under certain circumstances, poorer countries can catch up faster with the leading (richest) country than countries almost as rich as the richest one; it has been attributed to William Baumol [1986].

a resource-intensive structure of production might not be viable any more. To the extent that the current international position of the newly industrialising countries of South-East Asia (NICs) can be considered to constitute a prediction of the future profile of comparative advantage of Eastern European countries, it could be hypothesised that the comparative advantage of a transformed Eastern Europe could shift away from resource-intensive products towards labour-intensive products and easy to imitate R&D-intensive products (Table A 6).

The third factor potentially influencing the future role of Bulgaria in the world economy is the expected development of the international environment. Table 5 presents a summary of forecasts for GDP growth, world export growth, and the price of oil and capital. A slightly increasing real interest rate could imply that Bulgaria's external debt problem could become a serious burden if it were to remain unsolved (OECD 1992). It could also imply that foreign direct investment is bound to be scarce during the 1990s and that only the most attractive locations will see capital inflows. Since direct investment is also known as the main vehicle for technology transfer, Bulgaria would have to become competitive as a location of economic activity first in order to create the necessary conditions for future structural change and growth on the basis of Western technology.

A relatively low price of oil is good news to a country as Bulgaria with an important oil import bill and negligible own oil reserves. The same holds with regard to the growth rates of real income in OECD member countries of around 3 per cent. Expanding income will stimulate OECD imports and thus exports from non-OECD countries. A transformed and internationally competitive Bulgaria could benefit from OECD growth by attracting foreign direct investment from OECD member countries and exporting labour-intensive and easy to imitate R&D-intensive products to the OECD region.

After experiencing a contraction of real GDP of 26.4 per cent in 1991 (Table 1), the Bulgarian economy can be expected to recover only slowly during the first half of the 1990s; higher growth rates should be un-

Table 5 - Forecasts for the World Economy 1990 - 2000

Indicator	Trend	World Bank		Project WEFA		DRI
	1965- 1989	1900- 2000		1991- 1995	1991- 1995	1991- 1995
		A	B			
OECD countries						
Real GDP Growth <sup>a</sup>	3.1	2.9	2.2	2.8	3.2	3.1
Real rate of interest <sup>b</sup>	3.1	3.4	5.1	4.0	4.3	4.9
World export growth <sup>a</sup>	4.1	5.8	4.5	5.6	4.3	NA
Change in the real price of oil <sup>a</sup>	9.3	-0.6	0.9	0.9	0.8	-2.0
<sup>a</sup> Average annual rates of growth; - <sup>b</sup> levels.						

Source: World Bank [1991b].

likely before 1995. The foreign exchange bottleneck, exaggerated by the consequences of the foreign debt, could keep imports on a relatively low level until 1995. Since growth will need to be fuelled by new investment and the latter is dependent on the country's capacity to import new machines and equipment from the West, conservative expectations could reasonably see growth of 2 to 3 per cent p. a. taking place towards the second half of the 1990s. Table 6 summarises some of the available forecasts for the Bulgarian economy.

### III. Energy Supply and Demand<sup>1</sup>

#### 1. Resource Endowment and Domestic Production of Primary Energy

Bulgaria has only very few valuable domestic energy resources. Proven

<sup>1</sup> If no other source is explicitly given, data mentioned in this chapter has been provided by the Committee of Energy.

Table 6 - Forecasts for Bulgarian Real GDP Growth 1992 - 2000 (per cent)

Indicator	Scenario	1992	1993	1994	1992-2000
Real GDP Growth	low	-15.0 <sup>c</sup>	1.0 <sup>c</sup>	2.0 <sup>b,c</sup>	2.0 <sup>b</sup> to 3.0 <sup>c</sup>
	high	-8.0 <sup>b</sup> to 2.0 <sup>a</sup>	2.0 <sup>b</sup> to 5.0 <sup>a</sup>	5.5 <sup>a</sup>	5.1 <sup>a</sup>
<sup>a</sup> World Bank estimate; <sup>b</sup> OECD estimate, <sup>c</sup> own estimate.					

Source: World Bank [1992a]; OECD [1992]; own estimates.

oil and gas reserves - never important - have been declining and the country's hydropower potential is very limited; existing uranium resources are of low grade. Coal, the only abundant resource, is of low quality. Accordingly, coal accounts for 56 per cent of the domestic production of primary energy; it is followed by nuclear power and hydropower (43 per cent) (Table A 16).

Lignite reserves (1990: 2350 Million t were considered to be minable at current domestic prices and technology) are concentrated in one site, the open-pit deposit of Maritza-East. Assuming the present production rate were maintained, these reserves could last for about 85 years. Sub-bituminous (210 Million t), bituminous (10 Million t) and anthracite (1 Million t) coal reserves are not only small, but probably not economically recoverable. Also, a recent discovery of hard coal in North-east Bulgaria, lying at an average depth of around 2000 m, might not be commercially recoverable. Furthermore, while lignite presents an extremely low heating value (about 2.7 times lower than anthracite) and a high ash and sulphur content, sub-bituminous coal is characterised by a high ash content.

Production of all coal types declined in recent years, with the production of anthracite falling most (Tables A 7 - A 9). Lower investment in coal mining, complex geological structures difficult to be mastered applying obsolete technology, problems in the provision of spare parts and new mining equipment by the former Soviet Union, and the slowdown in economic growth in the 1980s followed by the current deep recession are some of the factors blamed for this development.

Though proven high-quality hydrocarbon reserves are estimated at only 13 Million barrels of low-sulphur oil and 5 Billion cubic meters of natural gas without sulphur and sulphur compounds (Petroleum Intelligence Weekly 1991), the geological prospects for finding onshore and especially offshore hydrocarbons are considered to be one of the best in Eastern Europe. Large-scale onshore surveys began as early as 1947 and offshore geophysical studies were carried out since 1960. Due to the use of obsolete (mainly Soviet) technology in the past and to the fact that many parts of the country, including some areas of the continental shelf in the Black Sea, appear to have been explored only lightly, the probability that up-to-date technology, particularly computer-based seismic interpretation, could reveal the existence of commercially interesting oil and gas resources appears to be very high. Another 500 to 1500 Million barrels of oil in reservoirs of 100 to 300 Million barrels each could be possible (Petroleum Intelligence Weekly 1991). Production of oil and gas has been falling for a decade as a consequence of a lack of new reservoir discoveries (despite considerable government investment in exploration), a deterioration of infrastructure and operational equipment, and the adverse development of the Bulgarian economy in the 1980s (Tables A 10 and A 11).

There are no reliable estimates of total Bulgarian uranium resources. It is known, however, that the uranium produced in 6 mines and in 11 in-situ leaching facilities is of low grade. The yellow cake (uranium concentrate) used to be exported to the Soviet Union for upgrading (and then re-imported by Bulgaria). Cumulated uranium production (1961-1989) reached about 9570 t metal content, i. e., 330 t metal per year on average. Production fell to 270 t in 1990 and was finally stopped 1991, be-

cause the Soviet Union suspended its purchases. According to the World Bank, Bulgarian yellow cake production is not profitable at current world market prices (World Bank 1991a).

## 2. Domestic Production of Electricity and Oil Derivates

There are three sources of electricity in Bulgaria: domestic plants owned and operated by the Committee of Energy (COE) (1990: about 84 per cent of total supply), domestic plants linked to industrial conglomerates (8 per cent) and net imports from the former Soviet Union (8 per cent). Total generating capacity owned by the COE was 10896 MW in 1990, consisting of 5161 MW from fossil fuel (coal, heavy fuel oil, gas) fired plants, 3760 MW from the Kozloduy nuclear plant, and 1975 MW from hydropower plants (Table A 14). Together with capacity from industrial companies (1100 MW) and further (domestic) capacity dedicated under contract to the former Soviet Union, Bulgaria's total installed capacity for the production of electricity amounts to about 12000 MW. With the peak level of demand having reached 8332 MW in 1989, available capacity should normally be more than sufficient to meet domestic demand, at least in nominal terms. For several reasons, however, available capacity is much lower than installed capacity.

Almost 38 per cent of electricity produced in 1990 by the COE was generated at Kozloduy, 35 per cent in thermal power plants burning Bulgarian coal, 18 per cent in plants using imported coal, 4 per cent from plants burning heavy fuel oil and gas, and 5 per cent in hydropower plants. Two of the six reactors (pressurised water reactors made in the Soviet Union, using slightly enriched uranium as fuel) installed at Kozloduy are currently being overhauled following the emergency improvement programme implemented after the International Atomic Energy Agency raised serious objections concerning their operational safety. The programme, which is being coordinated, administered and financed by the Commission of the EC, does not allow to predict yet whether two other units - including the newest one - will ever be able to operate at full capacity. Another issue that could keep Kozloduy from operating near its maximum level is the still unsolved radioactive waste treatment and storage

problem. Formerly, the Soviet Union had committed itself to take back the used fuel volume resulting from burning upgraded uranium supplied by Soviet sources. This practice was discontinued in 1990. Plans to expand nuclear generation capacity by constructing a second plant at Belene have been shelved for the time being.

Many thermal plants, presenting utilisation rates averaging only 50 per cent (optimal rates amount to more than 80 per cent), are not only facing operational problems (boilers needing repairs or replacement) but also interruptions in the deliveries of both domestic and imported fuels. As was already mentioned above, domestic coal production has been declining for a number of years. For example, the Maritza East Complex, which receives lignite deliveries from a captive mine, had to adjust electricity output to coal deliveries more often than not falling short of the quantity required for full capacity operation. Another example is the power plant at Varna. The utilisation rate of this plant, designed to burn coal from the Ukraine or gas, has been fluctuating due to uncertain coal shipments from the Ukraine.

Out of the 87 hydropower plants located in Bulgaria, making up about 15 per cent of the country's nominal capacity to generate electricity, 11 plants account for more than 75 per cent of total hydropower capacity (Table A 15). Depending largely on the supply of water in the reservoirs and differences in altitude occurring in the normal path of rivers, Bulgaria's hydropower potential is limited. For Bulgaria is generally endowed with small rivers, the water load of which is very often affected by droughts, and the only important river, the Danube, has a rather small drop in altitude. Thus, for example, in the event of a dry year (as in 1990), a partial depletion of the water reservoirs used by the main 11 plants can substantially diminish the available hydropower capacity. In view of the recent dam constructed in Czechoslovakia that involved a deviation of the Danube, the water flow through Bulgarian territory should have diminished, thereby increasing the risk of water supply interruptions. Furthermore, given competing uses of Bulgaria's limited water resources, the current absence of an efficient water management policy could also lead to a reduced water availability for hydropower purposes.

Total Bulgarian electricity output began to rise steeply in the 1970s after the first reactors were activated at Kozloduy. While nuclear expansion continued throughout the 1980s, the contribution of hydropower to total output decreased, due to lower than normal precipitation in this period. Therefore, total supply could not rise as fast in the 1980s as it did in the 1970s; fluctuations in electricity generation by thermal plants did not alter the corresponding output share very much. Total production of electricity reached its maximum in 1988 (45036 Million kwh) and declined by 2, 5 and 8 per cent, respectively, from 1988 to 1991; our estimate for 1992 indicates a further decrease (Table A 13), reflecting the fact that power cuts were frequent during the Winter 1991/92.

Oil products are produced in refineries located at Burgas (Black Sea coast), Ruse (near the Danube river) and Pleven (near the biggest proven onshore oil field), with Burgas representing about 85 per cent of total domestic refining capacity. The latter includes facilities for atmospheric (12 Million t/year) and vacuum distillation (3.7 Million t/year) as well as other other purposes (catalytic reforming, hydro-treating, catalytic cracking, alkylation, visbreaking and MTBE production). Until 1991, it satisfied most of internal oil product demand. In addition, it has been reserving an increasing share of its capacity for third-party processing. Crude throughput at Burgas declined from some 12 Million t in 1988 to around 6-8 Million t in 1991, due to reduced Soviet deliveries and the country's inability to diversify imports in the presence of the foreign debt problem and the foreign exchange bottleneck. Although third-party processing also fell in 1990 (by some 40 per cent), some reports see a substantial expansion in this segment beginning in 1991 (Petroleum Intelligence Weekly 1991). Hard-currency fees earned in third-party processing are expected to widen the scope for both crude oil imports from new sources and local sales of a certain share of the refinery output. One of the remaining two small refineries is specialised in lubricants (Pleven), and the other one (Ruse) has been closed down.

While total Bulgarian refinery output began to decrease slowly in 1988



(Table A 12), the most important oil products rather showed production fluctuations in the second half of the 1980s (Tables A 17 - A 19). However, 1990 and 1991 represented a serious turning point for both total and individual output, with decreases of 38 and 54 per cent (total output), 34 and 51 per cent (motor and aviation gasoline), 41 and 52 per cent (gas-diesel oil), and 38 and 58 per cent (fuel oil). In part, this development is related to lower demand in the wake of the general contraction of economic activity, but mostly to the already mentioned reduced deliveries of crude oil.

### 3. Transmission of Energy

Electricity, heat, natural gas and refined oil products are generally transported either through grids or by pipeline in Bulgaria; there is no crude oil pipeline. Only in 1959, the first 110 kV electricity line with a length of 1985 km came into being. By 1970 also a 220 kV line was in use and the domestic electricity grid was in a position to carry power to most parts of the country. Further developments in the 1970s and 1980s added a 400 kV line to the system, including the possibility to convert 400 into 110 kV; currently there is a total number of 24 converters of the 400/110 kV type. Following the installation of low and middle voltage lines (10 - 20 kV), 279 converters of the 110/20 type were built. In addition, in order to establish a link with the former USSR, particularly with the Ukraine, a 750 kV line was constructed. As can be seen from Table 7, Bulgaria's national electricity network is quite developed.

Bulgaria's electricity grid is connected with all neighbouring countries. Through the MIR (or IPS<sup>1</sup>) system, Bulgaria is synchronised with the former CMEA countries, notably with the Ukraine and Romania. With ex-Yugoslavia and Greece, both a part of the West European UCPE<sup>2</sup> network, Bulgaria is linked on the basis of the so-called isolated island

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<sup>1</sup> Interconnected Power Systems.

<sup>2</sup> Union for the Coordination of Production and Transport of Electricity. This is the world's most important grid (384 Gigawatts).

Table 7 - The Length of Bulgaria's Electricity Lines by Voltage Levels 1970-1990 (in 1000 km)

Voltage	1970	1975	1980	1985	1990
Low	48.7	54.2	60.0	63.2	67.8
Middle	36.6	43.5	50.2	56.7	61.8
110 kV	1.7	1.9	2.1	2.2	2.3
400 kV	-	0.6	1.0	1.5	1.8
750 kV	-	-	-	-	0.085

Source: Committee of Energy.

principle (= partial synchronisation), due to the different standards prevailing in the Eastern and Western grids. Also, Bulgaria is connected with Turkey, a country not participating in either the IPS or the UCPE grids, but flexible enough, as far as the technical standards are concerned, to exchange power with countries belonging to both grid systems.

Similar to other segments of the energy market, the transmission and distribution of electricity shows a series of operational problems associated with poor service, a low level of investment and a lack of spare parts and new equipment. In particular, the low and middle voltage lines are not performing to their full capacity. Official data reveal transmission and distribution losses of the order of 10 to 12 per cent of total electricity supply in the 1980s, a level that matches quite well the average losses observed in less developed countries. Furthermore, since Bulgaria is a net importer of electricity, the unreliability of supplies from the Ukraine and the problems affecting domestic electricity supply could call for a synchronisation of Bulgaria's grid with Western Europe's.

Bulgarian natural gas imports from the ex-USSR enter the country through a pipeline coming from Romania; it has a nominal capacity of 9-bcm/year and mainly supplies the petrochemical complex in Stara Zagora. A second

pipeline of similar capacity crosses Bulgaria only to supply Soviet gas to Greece and Turkey. An oil product pipeline (carrying diesel) links the Burgas refinery with the storage depots in Sofia. There is no information on the distribution of heat.

#### 4. Foreign Trade in Primary and Final Energy

As a country poorly endowed with energy resources, Bulgaria resorts to international trade to satisfy an important share of her demand for primary and final energy. According to the energy balances for 1990/91, total energy imports, expressed in standard physical units, amounted to about twice as much as the domestic production of primary energy (Tables A 9 and 21). Some 38 per cent of the total domestic input of coal was of foreign origin as well as almost all crude oil and natural gas, and half the quantity of oil products used. Net imports of electricity reached 11 per cent of total domestic electricity supply. Coal imports mainly consisted of hard as opposed to brown coal, and of coke. Refined oil product imports referred particularly to fuel oil.

In 1991 imports of fuels, minerals and metals accounted for the single most important share of total import value from all regions (about 59 per cent). On a regional level, former CMEA member countries and LDCs were the main sources of fuel imports. Nearly 72 per cent crude oil came from the former USSR, with LDCs (especially Algeria, Lybia, Iran) providing the rest; due to the UN embargo against Irak in the wake of the last Gulf War, imports from this country - formerly a relatively important supplier - were interrupted. The former USSR provided natural gas (100 per cent), coal (80 per cent) and oil products (38 per cent). Electricity was mostly supplied by Russia and the Ukraine through the CMEA grid "MIR", with Greece, Turkey and Albania providing only small quantities each.

The slowdown in economic growth experienced by Bulgaria after 1970 but especially in the 1980s along with the deterioration of this country's foreign trade and payments position had an impact on net energy imports. As can be seen from Tables A 7 - A 13 and A 16 - A 19, imports (ex-

pressed in physical units) decreased substantially in the period 1985-1991. Hard coal, coke, crude oil, refined oil products, electricity imports fell by 50, 81, 68, 20, 50 per cent, respectively. The foreign supply of natural gas first increased, reached its maximum in 1990 and then fell by 17 per cent in 1991. Imports of refined oil products, as motor and aviation gasoline, and fuel oil, contracted by 32 and 48 per cent, respectively, between 1985 and 1991.

One of the fundamental factors affecting Bulgaria's energy imports from the former USSR was the collapse of the traditional CMEA clearing system with trade valued in transfer rubles, an accounting currency unit, and the former USSR switching to world market prices and hard currency in January 1991 as far as energy exports were concerned. In the old system, the USSR charged a five-year moving average of world prices expressed in transfer rubles using an extremely overvalued exchange rate vis-a-vis the US dollar. As long as this moving average remained below world market prices, CMEA member countries as Bulgaria had the opportunity of importing subsidised quantities of primary and final energy. This seems to have been the case for crude oil until May 1983 and again during the last Gulf War; from May 1983 to July 1990 the opposite seems to have been true (Foders 1991). Energy imports were generally paid for with goods in the framework of bilateral countertrade arrangements. Since these goods were overpriced and only rarely competitive in the markets of the West, a further subsidy was implicit in this type of exchange that, in the long run, rather reduced the scope for a regional diversification of exports. For a long time, at least as long as CMEA energy prices were set lower than world market prices, terms of trade appear to have developed favourably for the energy-importing member countries of the CMEA. Some countries, notably Bulgaria, however, were able to further improve their terms of trade by using 'cheap' crude oil imports to produce refined products that could be sold in the West for hard currency and at world market prices. Although the distortions characterising the CMEA region thus paradoxically resulted in both integration effects (trade diversion and trade creation in the energy field) and terms-of-trade effects, potential benefits seem to have been more than compensated by the risks implied by the development of an uncompetitive

industrial structure and the high dependence on subsidised energy imports from mainly one source. In recent years, the breakdown of the CMEA payments system and the sharp decline of energy exports from the former USSR to Central and Eastern Europe, due to serious disruptions of energy production, transport and trade in the former USSR (Fodors 1991), fully revealed the major weaknesses of intra-CMEA economic relations.

#### 5. Energy Consumption by Sources and Economic Sectors

Bulgaria is a major energy consumer. As compared to other Central and Eastern European countries and measured by the per capita consumption of energy, Bulgaria was fourth in the ranking in 1965, after Czechoslovakia, Poland and Hungary (Table 8). In 1990, Bulgaria was only second to Czechoslovakia. Interestingly, the low-middle-income countries with a similar per capita income as Bulgaria showed a much lower level of energy consumption in 1990, although Algeria's consumption grew much faster than Bulgaria's and Malaysia's consumption expanded at the same rate as Bulgaria's in the period 1965-1990. As measured by energy intensity of GDP at current exchange rates, Bulgaria is characterised by an efficient use of energy; as Romania's too, Bulgaria's economy requires a comparatively high input of total energy per unit of GDP (Table 8).

In contrast to the diversified structure of the total input of primary and final energy into the Bulgarian economy (as shown by the energy balances in Tables A 19 and A 21), almost half of final energy consumption is concentrated in oil products (46 per cent). Natural gas, coal and electricity account for about 16 per cent each, leaving only 6 per cent for heat.

Most energy is being used in the manufacturing industry, where iron and steel (16.5 per cent of industrial consumption) and chemicals (40 per cent) account for the highest shares. Industry is followed by households (19 per cent of total consumption); all other sectors (agriculture, construction, transport, the public sector) are rather small consumers.

Table 8 - Energy Consumption in Eastern Europe and Lower-Middle-Income Countries 1965, 1990

Country	Per Capita Consumption of Energy			Energy Efficiency 1990 <sup>b</sup>
	kg of oil 1965	equivalent 1990	average annual growth rate 1965-90 (per cent)	
Bulgaria	1788	4945	4	2.2
Czechoslovakia	3374	5091	2	1.6
Hungary	1825	3211	2	1.2
Poland	2027	3416	2	2.0
Romania	1536	3623	3	2.2
Eastern Europe <sup>a</sup>	2110	4055	3	1.8
Algeria	226	1956	8	1.0
Malaysia	313	974	4	0.4
Argentina	975	1801	2	0.8
Lower-Middle-Income Countries <sup>a</sup>	826	2419	4	1.1
<sup>a</sup> Unweighted average; the figure for the lowe-middle-income countries includes Bulgaria;				
<sup>b</sup> energy consumption per unit of GDP at current exchange rates.				

Source: World Bank [1992b]; - own calculations.

Industry is the biggest user of natural gas (99 per cent), coal (56 per cent), electricity (47 per cent), and oil products (45 per cent), whereas industry and households together consume the lion's share of the supplied heat (about 38 per cent each). Households are also important as electricity users; they do not use natural gas. The manufacturing of chemicals is the most energy intensive activity, as far as oil products, natural gas and electricity is concerned. The production of iron and

steel is very coal intensive. Food, beverages and tobacco also need a quite high input level of energy, particularly of oil products, electricity and heat. Finally, textiles, clothing and leather manufacturing require more heat than any other industry.

The available data and information on the demand side of the Bulgarian energy market do not allow a deeper analysis either by sources or by economic sectors. From the figures representing apparent consumption of primary and final energy resources (Tables A 7 - A 13 and A 16 - A 18) some conclusions may be drawn regarding the evolution of this gross measure of consumption in the period 1985 - 1991. In spite of the still high level of energy consumption in Bulgaria, apparent consumption of most energy sources decreased during the second half of the 1980s. While hard coal suffered a contraction of about 50 per cent, crude oil and refined oil products fell by 66 and 58 per cent, respectively. The demand for electricity and brown coal only showed a comparatively minor decrease, whereas the consumption of natural gas increased somewhat. The consumption of oil products was also reduced. These developments seem to indicate quite well the close relationship between economic growth and energy use. The slowdown in economic growth in the 1980s as well as the recession experienced in recent years had a clear impact on Bulgarian energy consumption.

#### 6. Environmental Aspects

Bulgaria's industrialisation strategy resulted in a heavy burden for the environment. With air, water and land resources systematically underpriced the exposure of these resources to pollutants stemming mainly from heavy industry and the energy sector resulted in a high social cost of economic activities under the old regime. The overall environmental picture includes features such as the contamination of drinking water sources, air pollution in urban areas and in regions in which industrial or mining complexes are located, and the use of valuable agricultural land to dump waste. The legacy of the past thus points at another topic that should rank high on the agenda of economic transformation: environmental policy.

To what extent can the environmental status of Bulgaria be attributed to the energy sector? Table 9 shows the main sources of sulphur dioxide emissions related to energy use. Thermal power plants turn out to constitute the single most important source, particularly those plants that burn domestic (high sulphur, low caloric value) lignite. The use of high-sulfur brown coal briquettes in households, generally for heating, makes them the second source of air pollution with  $\text{SO}_2$ , especially in residential zones. The intensive utilisation of coal is also associated with emissions of carbon dioxide (Table 10), which appear to be excessively high in Central and Eastern European countries, due to the dominant role of coal in their energy mix. As far as Bulgaria is concerned, there are two main sources of  $\text{CO}_2$  pollution, coal and oil, which is why Bulgaria comes very close to the average fuel shares in  $\text{CO}_2$  emissions for the world. Eastern Europe accounted for about 6 per cent of global  $\text{CO}_2$  emissions in 1990 and is expected to slightly reduce its share to 5 per cent in 2050, according to simulations with the OECD's GREEN model for a scenario with no substantial changes in national environmental policies around the globe (Table 11).

Besides the energy mix, another major reason for the important contribution of the energy sector to environmental pollution is the level of energy consumption. As expected, estimates for the income elasticity of energy demand in Eastern Europe are somewhat higher than those for the EC member countries and the US (Table 12). They seem to be at par with the average elasticity for the world, due to the fact that energy demand in rapidly growing developing countries (Brazil, China, India and other newly industrialising countries (NICs) from Southeast Asia) exceeds the level observed in Eastern Europe. As in many NICs, the relatively high income elasticity of energy demand in Eastern Europe reflects energy price distortions (mainly subsidies) and their impact on the choice of production technologies at the firm level. Interestingly, in the case of Eastern Europe the carbon dioxide elasticity matches the energy elasticity, whereas in the EC and the US the carbon elasticity turns out to be lower and in the former USSR as well as in the less developed countries it turns out to be higher as the energy elasticity (Table 12). This seems to underline the close relationship between  $\text{CO}_2$  emissions and energy use in Central and Eastern Europe.



Table 9 - SO<sub>2</sub> Emissions in Bulgaria 1980, 1987, 1990

Source/Fuel Regional Power Plants	Sulphur Content of Fuel (per cent)	SO <sub>2</sub> Emissions (Million tons)		
		1980	1987	1990
<b>Thermal Power Plants</b>				
Lignite	2.5	0.9	1.2	0.8
Sub-bituminous coal	1.7	0.1	0.1	0.1
Sub-bituminous coal	3.0	0.1	0.1	0.05
Anthracite	2.9	0.2	0.3	0.2
Oil Products	3.5	0.2	0.3	0.3
<b>Household Heating</b>				
Briquettes	4.5	0.1	0.1	0.1
Coal	2.5	0.05	0.04	0.02
Naphta	1.25	0.02	0.02	0.01
<b>Transport</b>				
Diesel	0.3	0.01	0.01	0.01
<b>Total</b>		<b>1.7</b>	<b>2.2</b>	<b>1.6</b>

Source: Committee of Energy; own estimates.

Table 10 - Fuel Shares in CO<sub>2</sub> Emissions in Selected Regions, 1985

Fuel	CO <sub>2</sub> Primary Emission Factor	CEECs <sup>a</sup>	Fuel Share			
			Former USSR	EC	USA	World
Coal	1.09	66.9	38.1	32.9	34.7	42.0
Crude Oil	0.84	20.1	33.4	51.8	46.7	42.2
Natural Gas	0.64	13.0	28.6	15.3	18.6	15.8

<sup>a</sup> Central and Eastern European Countries

Source: Burniaux et al. [1992a], Table 4.

Table 11 - CO<sub>2</sub> Emissions in Selected Regions<sup>a</sup> 1990 - 2050 (Simulation Results; Million tons of Carbon)

	CEECs <sup>b</sup>	Former USSR	EC	USA	World
1990	354	1010	813	1339	5815
2000	415	1221	884	1497	7071
2010	515	1536	944	1684	8705
2030	708	1975	1076	2020	12907
2050	909	2394	1273	2295	18998

<sup>a</sup> Simulations with the OECD's GREEN model; business as usual scenario;  
<sup>b</sup> Central and Eastern European Countries.

Source: Oliveira-Martins et al. [1992], Table 4.

Table 12 - CO<sub>2</sub> Emissions and GDP Growth in Selected Regions 1990 - 2000 (Simulation Results; per cent)

	Real GDP <sup>b</sup>	CO <sub>2</sub> Emissions <sup>b</sup>	CO <sub>2</sub> Elasticity <sup>c</sup>	Income Elasticity of Demand for Energy <sup>d</sup>
CEECsa	2.7	1.6	0.6	0.6
Former USSR	2.6	1.9	0.7	0.6
EC	2.2	0.8	0.4	0.5
USA	2.6	1.1	0.4	0.5
World	2.9	2.0	0.7	0.6

<sup>a</sup> Central and Eastern European Countries;  
<sup>b</sup> Annual average growth rates; simulation results; business as usual scenario;  
<sup>c</sup> Annual average growth rate of real GDP divided by the annual average growth rate of CO<sub>2</sub> emissions;  
<sup>d</sup> Extended Linear Expenditure System (ELES) Estimates.

Source: Burniaux et al. [1992a], Tables 3 (GDP) and 5 (CO<sub>2</sub> emissions); Burniaux et al. [1992b], Table 15 (income elasticities of energy demand); own calculations (CO<sub>2</sub> elasticities).

One of the major  $\text{SO}_2$  pollutants in Bulgaria is the large Maritza East power complex (about 700 000 tons of  $\text{SO}_2$  per year). Although this complex is endowed with high stacks for dispersion and electrostatic precipitators to reduce to environmental consequences of sulphur emissions, the sulphur concentration of this plant's emissions remains high. Also, mining in this area - the power plant is linked to a coal mine - has adversely affected thousands of hectares of agricultural land. Another important Bulgarian polluter is the refinery located at Burgas; it discharges big amounts of largely unfiltered wastewater into the Black Sea. Since environmental regulation including some of the severest standards in Eastern Europe traditionally existed in Bulgaria, the status of the environment is rather a result of the poor enforcement of such standards.

#### 7. Strengths and Weaknesses

The main strengths presented by the supply-side of the Bulgarian energy market can be summarised as follows:

Bulgaria uses a diversified basket of primary and final energy resources:

- the nominal installed capacity to generate electricity and to refine crude oil exceeds domestic demand;
- the geological potential for discovering onshore and especially offshore hydrocarbons is promising;
- Bulgaria is linked to international electricity and natural gas grids.

The supply side presents the following weaknesses:

- Bulgaria is only poorly endowed with primary energy resources and thus highly dependent on imports of primary energy;
- energy imports come mainly from one source, Russia, which is itself experiencing major supply disruptions;

- the available effective capacity to generate electricity falls short of peak demand, due to a serious deterioration of power plant and distribution equipment;
- the only Bulgarian nuclear plant does not comply with Western safety standards;
- a heavy environmental impact of primary energy production and transportation.

The demand side of the Bulgarian energy market is characterised by the following strengths:

- a large scope for improving energy efficiency and energy conservation in general;
- a large potential for energy savings looming in the transformation of the Bulgarian economy, particularly by reducing both the weight of energy-intensive industries in the future composition of the manufacturing sector and energy use in all sectors of the economy.

The weaknesses of the demand side can be summarised as follows:

- a low level of energy efficiency in all sectors of the economy;
- a high share of oil products and lignite in energy consumption;
- a heavy environmental impact of oil and coal use in terms of emissions of  $SO_2$  and  $CO_2$ ;
- the absence of taxes on energy consumption and environmental pollution and the poor enforcement of environmental standards.

#### IV. Energy Policy

Energy policy traditionally played a key role in Bulgarian economic policy. This is clearly reflected in the fact that this country opted for the former CMEA's energy-intensive industrialisation strategy, in spite of being poorly endowed with energy resources. The widespread dis-

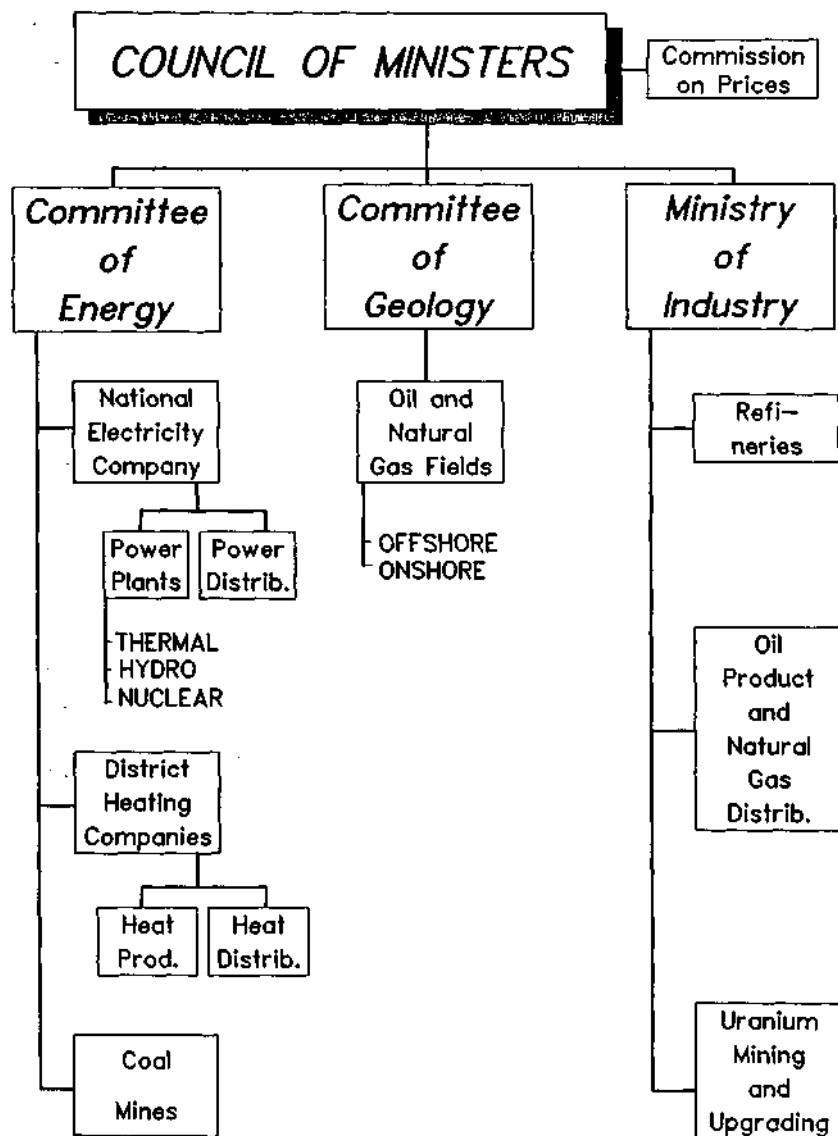
tortion of factor and product prices in the CMEA system blurred true factor

endowments and comparative advantage. National energy policy was thus expected to close the mounting gap between energy demand arising from energy-intensive industrialisation on the one hand and energy supply on the other. Energy supply consisted mainly of fuels imported from the former USSR; imports from non-CMEA countries were severely restricted by Bulgaria's limited access to foreign exchange. In an attempt to hedge against the risk of supply disruptions, Bulgaria drew heavily on locally available, low quality lignite and increasingly turned to the nuclear option, hoping to have found the shortest road to autarky in the energy field.

#### 1. Organisation of the Energy Sector

Although Bulgaria spent most of the post-war years practicing central planning, energy policy and its institutions were surprisingly decentralised. The energy sector consisted and still consists today of a series of companies and institutions reporting to different "committees" and ministries. As shown in Figure 1, the Committee of Energy, the Committee of Geology and Mineral Resources, and the Ministry of Industry are in control of most of the government-owned companies operating in the sector. In the past, the Ministry of Foreign Relations was in charge of the only Bulgarian energy trading company. Formally, the Council of Ministers takes investment decisions and is also responsible for energy pricing. In practice, the Council of Ministers sets prices at all levels but only determines the budget allocations for the energy companies. Details that relate to the use of funds in individual companies are generally dealt with at the committee or ministry level. Interestingly, such executive decisions are taken with no reference at all to a consistent energy programme with own policy objectives, but rather following objectives derived from national priorities concerning industrial development. Thus the underlying concept is that the energy sector is a service sector of the economy, oriented at servicing industry.

Figure 1 - Organisation of the Energy Sector  
in Bulgaria 1992



The inherited organisational structure of the energy sector is very likely to change in the event of total or partial privatisation of energy companies. For the time being, however, energy companies are not being prepared for privatisation. The only measure taken to strengthen these companies in the phase of economic transition was to create the legal background to transform them into joint-stock or limited-liability companies. Also, plans to foster the participation of private (mostly foreign) firms in some subsectors are not yet based on a comprehensive legal-institutional framework. For example, in the upstream segment of the oil and gas industry, in which the government is currently preparing the next round of licensing in the Bulgarian zone of the Black Sea continental shelf, both a consistent policy and the necessary legal and administrative infrastructure are still absent. In negotiating offshore licences with Western consortia the government is under pressure to proceed with the pertinent rules neither publicly known nor entirely fixed. Oil and gas projects being of a long-term nature, the participating foreign companies are expected to bear the risk of future changes in oil law, a fact that does not contribute to increase the (rather low) propensity to invest in the Bulgarian energy sector.

## 2. National Priorities for the Energy Sector

Until 1989, there were three official priorities for the energy sector: (i) to maximise the use of domestic energy resources, (ii) to rapidly expand the use of nuclear energy, and (iii) to stimulate energy saving. The first priority related to encouraging the utilisation of low quality lignite in thermal plants and in households. While the substitution of domestic coal for energy imports made sense as a short-run reaction to a transitory foreign exchange bottleneck, the second priority actually deepened Bulgaria's dependency on imports. The latter is due to the fact that Bulgaria had to import almost every input into nuclear plants and in addition lacked facilities to handle nuclear waste; as mentioned above, Bulgarian uranium ore is of low quality. The third official priority - energy saving - was never implemented. There was no allocation at all of investment for energy saving purposes and the government never created material incentives to save energy. The same applies to the pro-

tection of the environment from the discharges of polluting substances associated with energy production, distribution and consumption.

A non-official but in practice extremely relevant priority concerned the improvement of foreign exchange earnings by re-exporting energy. The re-export generally affected refinery products derived from cracking crude oil from Soviet sources. Oil products were exported to Western countries at world market prices. The most important non-official priority concerned energy prices. The government was committed to maintain relatively low prices for all users. The national policy of subsidisation of energy consumption implied setting prices that were much lower than the domestic cost of production, importation and distribution of energy. The financial gap resulting from such a policy forced the electricity companies to operate permanently with deficits. The latter were at first entirely financed resorting to funds from the federal budget and later increasingly with bank loans, resulting in an important accumulation of internal debt by the sector (1991/2: about Leva 3.5 billion direct state credits and Leva 3 billion bank loans). The structure of prices typical for Bulgarian energy policy is heavily distorted in favour of households (Table A 22). While in Western countries households generally pay higher prices than industry, because it is cheaper to supply energy to major consumers than to households, in Bulgaria the opposite was and still is true.

Although after the Big Bang in February 1991 energy prices remained regulated, they were allowed to increase then and several times thereafter. This notwithstanding, energy prices increased at a much slower pace than the consumer price index, which is tantamount to say that they actually fell in real terms. Since the Leva was not devalued according to the difference between the domestic and the foreign rate of inflation, it has been overvalued for some time. Thus, the wedge between Bulgarian and world market prices for energy increased almost *pari passu* with domestic inflation (running at 80 per cent per annum at the end of 1992).

In the area of nuclear power, Bulgaria began to receive foreign help to



cope with problems associated with plant safety and the operation of the existing reactors.

### 3. Strengths and Weaknesses

The institutional and policy framework for the Bulgarian energy sector presents the following strengths:

- the sector is highly decentralised;
- energy companies are being transformed into joint-stock or limited-liability companies;
- nuclear safety problems have been identified and are being taken care of with foreign help.

The sector's weaknesses include the following aspects:

- there is no energy ministry. Responsibility for energy policy is not centralised;
- there is no coherent energy policy;
- energy consumption is still subsidised. Prices are regulated;
- the structure of consumer prices favours households and discriminates against industry and other major consumers;
- subsidisation of energy consumption has several consequences: (i) high domestic energy demand, (ii) inefficient use of energy, (iii) continuation of the soft budget constraint for energy companies and accumulation of debt, (iii) adverse environmental impact;
- there is no comprehensive legal-institutional framework for the production, distribution and consumption of energy;
- there is no privatisation plan for the energy sector;
- there is no policy for the participation of foreign companies in the energy sector (exception: offshore oil and gas);
- there is no explicit link between energy and environmental policy.

## V. Energy Policy Outlook: Possible Scenarios

Almost every economic activity in Bulgaria is of the energy-intensive kind. To the extent that the ongoing process of transformation influences some of the conditions which in the past supported the choice of energy-using technologies, the energy sector will be forced to undergo substantial structural changes, in order to adjust to the new fundamentals prevailing at both the micro and macroeconomic levels. The close relationship that exists between transition and energy policy implies that an exploration of possible scenarios, each of these representing alternative combinations of transition and energy policies, could contribute to the discussion of policy options for Bulgaria. Drawing upon the economic analysis of the Bulgarian energy market and public policy in Chapters II to IV of this report, we shall now turn to assess several hypothetical scenarios with the intention to shed some light on the probable development of the energy sector in Bulgaria in the 1990s.

The first scenario to be addressed here is the base case, in which virtually no change takes place compared to the situation observed in 1992; it is being assumed that the current policies will be continued until the end of the decade (Scenario A). This scenario involves a long period of recession-cum-inflation, with the corresponding high social cost in terms of unemployment, real income losses, and capital flight. Under these circumstances, the transformation process could slow down, thereby adversely affecting the recent privatisation initiative as well as the overall level of involvement of (local and foreign) private firms in the economy. Economic stability will not be achieved and Bulgarian economic policies will quickly lose credibility both in the country and abroad. Foreign debt will remain a problem. With neither a liberalisation of energy prices nor foreign direct investment in the energy sector in sight, the crisis of the Bulgarian energy sector is likely to deepen, even if energy demand were to significantly fall in the wake of the recession. The country, traditionally dependent on primary energy imports (crude oil, hard coal, natural gas, and enriched uranium) and the production of indigenous lignite, will be forced to continue and possibly further deepen its dependency on lignite and nuclear power; the general

macroeconomic situation and especially the foreign exchange constraint would reduce the already narrow scope for imports. To maintain oil imports at past levels would mean to further increase foreign debt. It is difficult to predict whether the nuclear power plant at Kozloduy will be able to operate at an acceptable level of capacity for the next decade without substantial new investment. The risk of a major accident looms large today; in the base case scenario no significant improvement in the plant's safety is foreseen during the 1990s. The status of the environment will predictably deteriorate in a setting in which the traditional reliance on high-sulphur lignite is bound to increase, while investment in desulphurisation and similar facilities is neglected.

The role of energy policy in the base case does not differ much from the one energy policy had during the reign of central planning: it has the responsibility to make ends meet, that is to make demand and supply match, a task virtually impossible to be achieved as long as fundamental macroeconomic disequilibria are tolerated by economic policy. In such a scenario energy policy could turn out to be irrelevant.

The second scenario (Scenario B) assumes that stabilisation succeeds and the recession is overcome. According to the forecasts for the Bulgarian economy presented in Table 6 a low and a high growth scenario seem plausible. In the low scenario Bulgaria grows at a lower rate than in the high scenario. The salient features of both growth paths, which differ in the length of the time period needed to recover from recession and reach positive rates of real GDP growth, include price stability, higher employment, higher investment (of domestic and particularly of foreign origin), a rather undervalued exchange rate, a satisfactory international settlement for the foreign debt problem, export growth, etc. On the energy side, energy demand picks up *pari passu* with economic activity. Some segments of the energy market are privatised and capital and technology inflows help to improve the sector's efficiency, safety and environmental standards.

Under the conditions prevailing in Scenario B, energy policy again becomes relevant. Price liberalisation would be the measure most urgently

needed; the domestic structure of energy prices should reflect international prices (all other inputs being valued at cost or international prices). This will make a valuation of Bulgarian products and services at international prices viable. Once the former (artificial) comparative advantage in energy-intensive goods and services disappears, Bulgaria's economy will be forced to lower the energy intensity of production in order to increase its competitiveness in the world market. A lower energy intensity would lead to a lower domestic demand for energy. A new structure of fuel prices and a lower overall demand for energy will call for structural change in the Bulgarian energy sector.

What are the options for Bulgarian energy policy in a growth scenario? Options should be requested to comply with at least two criteria: (i) the compatibility with the current structure of energy prices in Europe (in particular in the EC member countries) and (ii) the compatibility with Bulgaria's resource endowment. Considering these restrictions, one option for Bulgaria could consist in increasing the share of natural gas in the national fuel mix (Option E1). Natural gas could be imported from Russia through an already existing pipeline; new pipelines would have to be built to distribute the gas within the country. Investment in thermal power plants would make the shift from lignite to natural gas viable. The remaining fuels (lignite, oil, hydro and nuclear power) would contribute to a diversification of Bulgaria's energy sources. Another option would be to continue and further strengthen the reliance on imported oil (Option E2). A third option could be to maximise the share of nuclear energy in the national fuel mix (Option E3).

Finally, a fourth option would be to concentrate on conservation as the main source of energy, letting prices and costs determine the optimal fuel mix for Bulgaria (Option E4). In options E1 to E3 taxes should be used as policy instruments to achieve the respective aims; in contrast, option E4 relies entirely on price liberalisation.

The use of natural gas (E1) would fulfil the price criterion, in view of the fact that world reserves of natural gas by far exceed oil reserves. Also, about 40 per cent of total gas reserves are located in the former

USSR, mainly in the Russian Federation, which means that transport costs do not have a major impact on the supply cost of gas for Bulgaria; this also satisfies the resource availability criterion, at least in part. Another 40 per cent of world reserves can be found in the OPEC member countries. In case Russian supplies should become permanently unreliable, a pipeline to one of the nearest OPEC countries could be built. However, apart from minor disturbances, Russian supplies to Western Europe (for example to Germany) have not yet proved to be generally unreliable. Furthermore, from the point of view of environmental protection, natural gas is much "cleaner" than hard coal, lignite and oil. Natural gas could substitute for lignite in most power plants and, in addition, serve residential purposes (heating, cooking).

An increase in the share of oil in Bulgaria's fuel mix (E2) would have a series of adverse effects. First, the world reserves of crude oil are concentrated in the OPEC countries (78 per cent). This fact increases the probability for an increase in the real price of oil in the long run. Thus, Bulgaria, as a net oil importer, could become vulnerable to an uncontrollable oil bill. Second, as many Western countries have experienced, the environmental impact of an intensive use of oil is considerably higher than the one of natural gas, particularly as far as carbon dioxide is concerned, even if it is still somewhat lower than the one of lignite or hard coal. Thus, although today oil is one of the relatively cheap fuels, a greater reliance on oil creates the risk of future oil price increases, even if the transport cost of oil (from Russia or some OPEC member country) to Bulgaria would be negligible.

A full reliance on nuclear power (E3) assumes that every stage of the nuclear process can be operated profitably in Bulgaria. As a country endowed with very low grade uranium, Bulgaria will have to import enriched uranium. Furthermore, Bulgaria will remain an importer of nuclear technology, equipment, spare parts and repair services. Also, the recycling and/or dump of nuclear waste cannot as yet be done in the country; the corresponding services will also have to be imported. Also, it is questionable whether the existing plant at Kozloduy will have a long life. Technically, it will be difficult (and expensive) to achieve

Western safety standards in the old Soviet built reactors. Therefore, as elementary analysis shows, nuclear power does not appear to constitute either a profitable choice or an opportunity for Bulgaria to increase her independence from foreign energy supplies.

Finally, the conservation option (E4) implies that the liberalisation of energy prices at all levels will lead to a lower overall energy intensity in the Bulgarian economy and thus to a lower level of energy demand. Higher energy prices would create incentives for a substitution of energy for capital and labour, and for energy saving. With an efficient use of energy resources in an economic setting in which production factors as well as products and services are valued at international prices, the lower level of energy demand will relieve the country from the pressure to import hydrocarbons and to maximise the use of high-sulphur lignite and high-risk Soviet nuclear technologies. In the long run, this option will pave the way for the country to arrive at an optimal fuel mix, subject to the international prices of fuels and capital.

Whichever option the Bulgarian government should select, two additional aspects should be given a leading role in the process of designing an appropriate energy strategy: (i) the environmental impact of energy production, distribution and consumption, and (ii) the opportunities derived from the European Energy Charter, particularly in view of the recent association of Bulgaria to the EC. Environmental issues currently rank high on the policy agenda of OECD countries. One of the most important topics discussed by these countries is the global reduction of greenhouse gases, particularly of carbon dioxide. The alternative policy instruments proposed to reduce global carbon emissions include the introduction of a carbon tax in the OECD member countries, the introduction of an energy-cum-carbon tax only in the EC member countries, and the implementation of a Toronto-type agreement with the participation of many countries (including developing, Eastern European and CIS countries).

As can be inferred from Table A 23 in the Appendix, global carbon emissions can be best reduced through a collective move of the kind implied

by the Toronto agreement. The reason for this seems to be that, due to the drastic reduction of energy consumption and the generally low growth rates observed in the OECD member countries, emissions are increasingly concentrated in the developing countries and in Eastern Europe and the CIS. Thus, the global impact of unilateral OECD or EC moves is likely to be only marginal. Since the energy sector is a major contributor to carbon emissions, this underlines the global importance of designing energy strategies in Eastern Europe, which explicitly take into account environmental aspects. At the same time, national policies (liberalisation of prices) could significantly reinforce the total effect of concerted action on an international level (Table A 23). According to simulations carried out with the OECD's GREEN model, the cost of reducing carbon emissions (in terms of real income losses) will be negligible, also for Eastern European countries (Table A 24).

Therefore, environmental policy in Bulgaria should be closely linked to energy policy, which means that it should focus on energy-related pollution. The state of the art in environmental economics (Cropper, Oates 1992) suggests that Pigouvian taxes could be the appropriate (albeit second-best) policy instrument for pollution control in Bulgaria, even if marketable permits cum legal liability were to be a first-best option for an OECD member country. The reason is that two criteria concerning the viability of policy instruments under the general conditions prevailing in Eastern Europe point towards a tax solution: simplicity and the level of enforcement costs. Certain taxes are easy to administer (compared to marketable permits and legal liability) and cheaper to enforce than marketable permits, emission standards and legal liability. For it to be truly simple and effective, however, an environmental tax should be designed having in mind the "polluter pays principle" on the one hand and the list of inputs (fuels) or outputs (goods and services) embodying or otherwise related to the pollutant focused upon ( $\text{CO}_2$ ,  $\text{SO}_2$ ). An alternative approach would be to concentrate the tax burden on energy consumption (for example, on a BTU basis).

The European Energy Charter, signed by countries located in the geographical "Europe" (East and West, including the former USSR) and the

G-24, has three main objectives: the expansion of trade in energy, co-operation and coordination in the energy field, and an optimum use of energy and environmental resources. These objectives entail a removal of trade barriers for energy and associated equipment, the transfer of Western technology, the promotion of energy sources with a relatively low environmental impact, and the development of new and renewable fuels. The benefits Bulgaria could reap from a participation in the actions envisaged by the European Energy Charter would encompass the accelerated access to the West-European electricity grid and to energy know-how and modern "clean" technologies. Specific agreements negotiated within the framework of the Charter could offer Bulgaria the additional opportunity to closely cooperate with the West in improving the safety of the nuclear plant at Kozloduy and modernising other power stations and the transmission of power and heat within the country.

#### VI. Summary, Policy Conclusions and Recommendations

Bulgaria is a small, lower-middle-income country of Eastern Europe undergoing economic transition from central planning to a market economy. On both the macro and the microeconomic levels the country currently faces significant disequilibria. The energy sector is among the sectors of the Bulgarian economy which were worst hit by these developments. Bulgaria is scarcely endowed with energy resources and traditionally resorts to foreign trade in order to satisfy a major share of her demand for energy. As a member country of the former CMEA, the country pursued an energy-intensive strategy of industrialisation during the period 1946 - 1989 and became highly dependent on energy imports from mainly one source, the former USSR. The recent collapse of the CMEA and the rearrangement of the economic relations of the former USSR disrupted Bulgarian imports of primary energy, thereby creating serious shortages of fuels in the country.

Bulgaria makes use of a rather diversified basket of primary and final energy. The domestic conversion of primary into final energy is severely hampered by operational problems arising from both the use of deficient



and obsolete equipment and shortages of fuel. Although nominal installed capacity for the production of electricity exceeds demand by far, power plants are unable to maintain high utilisation rates and to meet peak demand. In contrast to the supply side, the demand side of the energy market is biased towards oil products, which account for almost half of total energy consumption. Major consumers of energy are industry (particularly chemicals and iron and steel) and households. Furthermore, the low level of energy efficiency, the fuel mix and the high level of energy consumption have an adverse impact on the environment.

The current status of the energy sector can be associated with a policy that over a period of several decades favoured cheap energy and totally neglected investment in safety and environmental protection. Subsidised energy encouraged energy use and led to the emergence of an economic structure dominated by energy-intensive technologies. In addition, energy prices which did not reflect actual supply costs (domestic or international) contributed to the accumulation of debt by the energy companies. Since the structure of consumer prices for energy favoured households, instead of big users, the former enjoyed the major benefits from energy policy.

Although one would have expected a highly centralised organisation of the energy sector for systemic reasons, Bulgaria's public institutions and companies involved in the sector are rather decentralised. There is neither an energy ministry nor any other ministry with the power to design, implement and monitor energy policy; rather, the responsibility for energy matters is widely scattered. This is probably the reason for the current lack of a coherent energy policy in Bulgaria. The instruments of energy policy, as regulated prices, taxes and tariffs, are not employed to achieve energy or environmental policy goals. Also, a consistent policy for the participation of foreign companies in the energy sector is not in sight. Moreover, existing plans to privatise government-owned companies do not yet extend to the energy sector. The same applies to the new legal-institutional framework which does not include laws governing production, transmission and consumption of energy.

What conclusions can be drawn from the economic analysis of the Bulgarian energy sector? The first one is that energy reform cannot be separated from the transformation process; energy reform in fact is a central part of it, because market-oriented energy policies presuppose the existence of an economic setting free of major micro and macro-economic disequilibria. Energy policy instruments are generally ineffective in a setting in which important features of central planning (price controls) are retained or monetary and other disequilibria (inflation, foreign exchange restrictions, tax evasion, etc.) prevail. On the other hand, if energy prices are not liberalised, energy companies will have to bear operating losses which, in turn, will have to be financed from the government budget or by issuing new debt. Thus, gradual energy reform constitutes a burden for the general transformation process.

Second, energy reform encompasses domestic as well as international aspects. For a net importer of energy as Bulgaria, the integration of the domestic energy market into the international energy market makes energy reform easier than a protected, gradual road to world market conditions; gradualism postpones adjustment, thereby increasing its total social cost. Openness, in contrast, creates the opportunity to earn the foreign exchange needed to pay for import dependence in the energy field. Third, there is a close link between energy use and environmental pollution. This means that in designing energy policy one should take into account the environmental impact (or social cost) of alternative energy strategies. Fourth, energy reform calls for a comprehensive legal-institutional framework for the energy sector. Since energy projects are usually long-term ventures, the stability of energy regimes over time influences the propensity to invest in this sector. Fifth, energy transition will not be feasible without a consistent energy policy. Specific energy policy goals derived from a thorough analysis of the energy sector and its interfaces with other sectors of the economy should guide the use of policy instruments. Sixth, responsibility for the design, implementation and monitoring of energy policy should be centralised. For a credible implementation of consistent energy policies a minimum level of political and administrative authority might be necessary. Seventh, for a

country like Bulgaria, with a restricted access to the international capital market, the participation of private firms (domestic and foreign) might accelerate the reform of the energy sector. Private firms could provide the necessary capital and technology to modernise the energy sector. Privatisation could, thus, contribute to a reform of the energy sector by shifting some responsibilities from the government or government-owned firms to the private sector.

What measures should be taken in order to give Bulgaria relief from the present energy crisis and, at the same time, pave the way for a reform of the energy sector? In the short run, the following steps should be taken:

- a consistent energy strategy for Bulgaria should be designed and
- the responsibility for energy policy should be centralised.

In the medium run,

- a comprehensive legal-institutional framework for the energy sector should be created and
- as many energy companies as possible should be privatised.

An energy strategy for Bulgaria should follow a principle of prudent financial management: "never put all your eggs in one basket". A diversification of risk can be achieved by maintaining an array of fuels (at least two or three) each of which should be imported from several sources. Diversification of fuels and foreign suppliers is the best hedge against potential supply disruptions. In determining the cost-effective fuel mix for Bulgaria the government should not rely on judgement; market forces should indicate the cost-effective fuel mix. For this, energy prices in Bulgaria should truly reflect international prices. However, international prices could render some fuels produced in Bulgaria unprofitable. As a net importer, Bulgaria should aim at the cheapest sources.

Price policy could be complemented by tax policy. The simplest way to create incentives for energy conservation and environmental protection is by taxing energy consumption. In approaching energy taxation at the consumption level there are four basic considerations: (i) revenue raising, (ii) equity, (iii) correction of externalities and (iv) changing the fuel mix derived from market forces. There is also a presumption in favour of equal fiscal treatment of the various energy products. This ensures that distortive substitutions among competing fuels do not occur as a consequence of discriminatory taxation.

Revenue raising considerations focus attention on the price elasticity of demand and income elasticity of demand for energy. In this context, motor gasoline and diesel could be singled out as deserving a high level of taxation. In Bulgaria all the indications are that the demand for motor gasoline is both income and price inelastic. Although the stock of cars is still low compared to EC member countries, the number of vehicles is increasing rapidly, in spite of the relatively high cost of purchasing and maintaining a car, given the levels of income. Diesel fuel is used extensively in public transport and agriculture. Equity considerations are not appropriate in this case, even if it would benefit lower income groups which rely on public transport, because any differential favouring diesel over other fuels could also benefit high income groups and/or create incentives for a substitution of motor gasoline cars for diesel fuelled cars. It is preferable to help lower income groups through direct transfers than by distorting the value of a fuel. For similar reasons all available fuels should be taxed with the same tax rate, assuming domestic prices are in the range of international prices. Thus our recommendation involves a single ad valorem rate (as a percentage of the liberalised domestic price) for electricity, petroleum products, natural gas, coal (hard and brown) and heat. The revenue raised will probably be substantial given that the typical elasticities measured in Western countries also hold in Bulgaria.

Taxation can serve as an instrument to change the fuel mix derived from allowing market forces to determine fuel shares. In case a political decision should aim at achieving a better conservation of, say, coal than

of other fuels, an additional excise tax on coal sales to the consumer may be introduced. Similarly, the consumption of other fuels may be restricted by designing excise taxes for them. Externalities can also be corrected employing taxes. Pollution related to energy use can be reduced by restraining the consumption of polluting fuels through excise taxes. However, it should be noted that such a tax works indirectly and does not directly affect the polluter; thus, it does not offer incentives to introduce abatement devices. Effluent fees, in contrast, do offer such incentives but are not recommended here, because they are generally of a complex nature and assume a certain level of sophistication of the enforcing authorities. Also, the enforcement cost of effluent charges is likely to be high. Consumption-oriented environmental taxes could be selectively complemented with emission standards, applicable at least to the few major polluters (thermal plants, refineries, chemical complexes, etc.), which should be relatively easy (and cheap) to control. In case standards are not met, fines should be foreseen. Such a simple tax system could suffice to handle the environmental consequences of energy use in the 1990s.

Finally, in view of the association of Bulgaria to the EC, close cooperation between Bulgaria and the EC member countries could contribute to accelerate the reform of the Bulgarian energy sector. The association agreement mentions energy as an area for economic cooperation in several articles of Title VI (72, 73, 79, 80 and 81). While Article 73 refers to the coal industry, 80 to nuclear safety and 81 to environmental protection, Article 79 describes the areas to be served by technical assistance from the EC. This cooperation, which shall take place within the framework of the European Energy Charter, will cover, among others, the formulation and planning of energy policy, the development of (new) energy resources, the promotion of energy saving and energy efficiency, the modernisation of infrastructure, the improvement of natural gas and electricity transmission, and, most importantly, the opening of the EC energy market for natural gas and electricity for Bulgaria. With the latter opportunity, Bulgaria could, for example, increase its electricity imports and substitute them for electricity produced burning low grade, high ash and high sulphur domestic lignite. Moreover, cooperation

with EC member countries could foster technology transfer and the participation of private foreign firms in the restructuring of the Bulgarian energy sector. However, it remains the sole responsibility of the Bulgarian government to create the necessary local incentives for international cooperation.

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## A p p e n d i x A

Table A 1 - Bulgaria: Industry Structure 1991 (per cent)

Sector	Output Share
Mining	2.16
Coal	2.1
Oil and Gas	0.06
Energy	
Electricity and Thermal Power	8.2
Basic Industries	55.1
Ferrous Metallurgy	7.9
Non-Ferrous Metallurgy	3.6
Machine Building and Metals	10.1
Electrical Engineering	8.1
Chemical and Petrochemical	18.3
Construction Materials	2.5
Timber and Wood Processing	2.6
Pulp and Paper	2.0
Other Industries	34.54
Glas and Porcelain	1.1
Textiles	4.2
Weaving Apparel	1.3
Leather, Furs, Footware	1.1
Printing and Publishing	0.9
Food, Beverages, Tobacco	24.1
Other	1.84
Total	100.00

Source: World Bank [1992 a].

Table A 2 - Direction of Bulgaria's Foreign Trade by Region/Country 1990, 1991 (per cent)

Region/Country	Exports		Imports	
	1990	1991	1990	1991
OECD	11.87	26.28	21.62	32.82
- EC	7.87	15.66	16.29	20.66
Germany	4.23	4.76	10.39	6.97
Greece	0.80	2.18	0.32	0.89
Italy	0.78	2.70	1.91	4.17
United Kingdom	0.56	1.94	1.65	3.61
Others	1.50	4.08	2.02	5.02
- EFTA	1.54	3.37	3.23	7.81
- USA	1.74	3.36	0.55	2.87
- Others	0.72	3.89	1.55	1.48
Former CMEA <sup>a</sup>	76.27	54.96	68.35	49.06
- Former USSR	64.01	49.77	56.49	43.23
- Eastern Europe	12.26	5.19	11.86	5.83
Czechoslovakia	4.42	0.86	4.64	1.19
Poland	2.55	2.06	5.01	3.67
Romania <sup>b</sup>	3.86	1.83	1.32	0.43
Others <sup>b</sup>	2.42	3.21	1.75	2.49
LDCs	11.86	18.76	10.03	18.12
Total	100.00	100.00	100.00	100.00

<sup>a</sup> Only former USSR and Eastern Europe; <sup>b</sup> Albania and Hungary.

Source: PlanEcon Report [August 1992]; - own calculations.

Table A 3 - Commodity Structure of Bulgarian Foreign Trade by Regions 1990, 1992 (per cent)

Region	Exports		Imports	
	1990	1991	1990	1991
<b>All Regions</b>				
Machinery, equipment	59.1	30.6	46.2	15.8
Fuels, minerals, metals	7.7	10.5	33.6	58.7
Chemicals, fertilizers	3.9	10.9	4.5	5.1
Food raw materials	2.5	5.4	1.9	3.5
Processed foodstuffs	12.1	15.3	1.4	4.4
Industr. consumer goods	10.3	22.3	6.4	4.4
Other Items <sup>a</sup>	4.4	5.0	6.0	8.1
Grand Total	100.00	100.00	100.00	100.00
<b>OECD</b>				
Machinery, equipment	10.0	12.3	42.4	34.4
Fuels, minerals, metals	36.9	20.6	17.6	24.9
Chemicals, fertilizers	7.3	8.1	12.9	12.0
Food raw materials	19.6	23.5	10.8	17.4
Processed foodstuffs	11.4	12.4	4.9	2.1
Industr. consumer goods	12.1	20.0	8.7	7.4
Other items <sup>a</sup>	2.7	3.1	2.7	1.8
Total OECD	100.00	100.00	100.00	100.00
<b>Former CMEA</b>				
Machinery, equipment	65.4	35.2	51.7	8.3
Fuels, minerals, metals	4.2	4.6	33.7	77.7
Chemicals, fertilizers	2.1	9.5	2.9	1.8
Food raw materials	3.7	2.5	3.9	2.2
Processed foodstuffs	13.1	19.5	0.7	0.7
Industr. consumer goods	10.9	27.9	5.6	2.5
Other Items <sup>a</sup>	2.6	0.8	1.5	6.8
Total former CMEA	100.00	100.00	100.00	100.00
<b>LDCs</b>				
Machinery, equipment	50.2	39.7	4.7	2.3
Fuels, minerals, metals	10.6	17.0	59.3	65.5
Chemicals, fertilizers	14.9	19.4	4.1	1.6
Food raw materials	9.5	9.6	20.2	24.9
Processed foodstuffs	4.7	4.9	1.6	0.7
Industr. consumer goods	3.5	6.2	9.4	4.7
Other Items <sup>a</sup>	6.5	3.2	0.7	0.3
Total LDCs	100.00	100.00	100.00	100.00
<sup>a</sup> construction materials, agricultural non-food raw materials, live animals, material services.				

Source: PlanEcon Report [August 1992]; - own calculations.

Table A 4 - External Debt Indicators 1980, 1990

Country	Total debt as a percentage of				Total debt service as a percentage of		Interest payments as a percentage of	
	Exports		G N P		Exports		Exports	
	1980	1990	1980	1990	1980	1990	1980	1990
Bulgaria	2.9	135.9	1.1	56.9	0.3	16.7	0.2	6.4
Czechoslovakia	68.6	55.6	9.8	18.6	9.5	10.4	9.5	3.8
Hungary	95.9	188.6	44.8	67.8	18.9	37.9	10.8	15.2
Poland	54.9	251.5	16.3	82.0	17.9	4.9	5.2	1.6
Romania	80.3	5.5	NA	1.1	12.6	0.4	4.9	0.4
Eastern Europe <sup>a</sup>	60.5	127.4	14.6	45.3	11.8	14.1	6.1	5.5
Algeria	130.0	193.0	47.1	53.1	27.1	59.4	10.4	15.1
Malaysia	44.6	55.9	28.0	48.0	6.3	11.7	4.0	4.0
Argentina	242.4	405.6	48.4	61.7	37.3	34.1	20.8	18.4
Lower-Middle-Income Countries <sup>a,b</sup>	105.0	197.6	31.2	54.9	17.8	30.5	8.9	11.0

<sup>a</sup> Unweighted average; <sup>b</sup> the average for the lower-middle-income countries includes Bulgaria.

Source: World Bank [1992b], Table 24; - own calculations.

Table A 5 - Catching-up Potential<sup>a</sup> of Central and Eastern Europe and Lower-Middle-Income Countries 1985, 1990 (per cent)

Country	1985	1990
Bulgaria	31.0	27.8
Czechoslovakia	36.1 <sup>c</sup>	30.0 <sup>c</sup>
Hungary	23.4	21.8
Poland	18.4	15.9
Romania	30.0	23.8
Eastern Europe <sup>b</sup>	27.8	23.9
Algeria	27.8	21.9
Malaysia	25.0	37.0
Argentina	24.8	21.9
Lower-Middle-Income Countries	27.2	27.2

<sup>a</sup> Measured as a country's real GDP per capita as a percentage of the real GDP per capita of the US (= 100). International comparability of real GDP has been achieved using purchase power parities in 1985 prices. The figures presented here were corrected downwards (25 per cent) in order to account for the current unreliability of Central and Eastern European statistics;

<sup>b</sup> unweighted averages. The average of the lower-middle-income countries includes Bulgaria;

<sup>c</sup> own estimates.

Source: World Bank [1992b]; - own calculations.

Table A 6 - Revealed Comparative Advantage<sup>a</sup> of Central and Eastern European Countries in Foreign Trade with OECD Member Countries by Product Groups<sup>b</sup> 1970, 1980, 1988 (per cent)

Country/Region	I Raw-Material- intensive Products	II Labour- intensive Products	III Capital- intensive Products	R&D-intensive	
				IV Easy to imitate Products	V Difficult to imitate Products
<b>Bulgaria</b>					
1970	1.21	-0.51	-0.02	-0.78	-1.47
1980	1.11	-0.03	-0.38	-0.71	-1.06
1988	1.06	0.21	0.19	-0.35	-1.48
<b>Czechoslovakia</b>					
1970	0.40	0.50	0.38	-1.03	-0.76
1980	0.55	0.65	0.31	-0.85	-1.05
1988	0.90	0.67	0.64	-0.58	-1.39
<b>Hungary</b>					
1970	1.08	-0.33	-0.11	-1.20	-1.18
1980	1.13	0.11	-0.03	-0.83	-0.98
1988	1.58	0.10	0.01	-0.72	-1.15
<b>Poland</b>					
1970	0.93	-0.33	-0.46	-0.98	-11.52
1980	0.45	0.23	0.19	-1.08	-0.93
1988	0.93	0.17	0.21	-1.10	-1.03
<b>Romania</b>					
1970	1.44	0.18	-0.72	-0.57	-2.04
1980	0.47	0.79	-0.68	-1.24	-1.27
1988	0.00	0.33	0.52	-1.26	-0.88
<b>Asian NICs<sup>c</sup></b>					
1970	0.72	0.69	-0.89	-0.94	-1.70
1980	0.51	1.21	-1.29	-0.52	-0.89
1988	-0.03	1.16	-0.85	0.03	-0.76

<sup>a</sup> Calculated with OECD Foreign Trade Statistics using the following formula:  

$$\ln \left[ \frac{(x_i/x)}{(m_i/M)} \right]$$
with  $x_i$ ,  $m_i$ : exports (imports) of product group  $i$ , and  $X$ ,  $M$ : total exports (imports);

<sup>b</sup> I: SITC 0,2 (excl. 26), 3 (excl. 35), 4, 56; II: SITC 26, 6 (excl. 62, 67, 68), 8 (excl. 87, 88); III: SITC 1, 35, 53, 55, 62, 67, 68, 78; IV: SITC 51, 52, 54, 58, 59, 75, 76; V: SITC 57, 7 (excl. 75, 76, 78), 87,88;

<sup>c</sup> Hong Kong, Malaysia, Singapore, South Korea, Taiwan.

Table A 7 - Bulgaria: Production, Trade and Apparent Consumption of Hard Coal<sup>a</sup> (Million Metric Tons) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	223	8054	529	7748
1986	207	7304	306	7205
1987	198	7258	239	7217
1988	196	6451	23	6624
1989	193	6171	0	6364
1990	143	5790	0	5933
1991 <sup>b</sup>	120	3968	0	4088
1992 <sup>b</sup>	100	2500	0	2600

<sup>a</sup> Anthracite, bituminous and sub-bituminous coal;  
<sup>b</sup> estimate.

Source: Committee of Energy (Production); - PlanEcon Energy Report [1992/93]; own estimates [1992].



Table A 8 - Bulgaria: Production, Trade and Apparent Consumption of Brown Coal (Thousand Metric Tons) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	30657	0	0	30657
1986	35015	0	0	35015
1987	36621	0	0	36621
1988	33951	0	0	33951
1989	34105	69	0	34174
1990	31526	107	0	31633
1991	28680	87	0	28767
1992 <sup>a</sup>	28964	80	0	29044

<sup>a</sup> Estimate only.

Source: Committee of Energy (Production); - PlanEcon Energy Report [1992/93]; own estimates [1992].

Table A 9 - Bulgaria: Production, Trade and Apparent Consumption of Coke (Thousand Metric Tons) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	1087	664	0	1751
1986	1156	471	0	1627
1987	1314	309	0	1623
1988	1457	196	0	1653
1989	1561	93	0	1654
1990	1250	96	0	1346
1991	1000	124	0	1124
1992 <sup>a</sup>	900	120	0	1020

<sup>a</sup> First quarter estimate only.

Source: Committee of Energy (Production); - PlanEcon Energy Report [1992/93]; own estimates [1992].

Table A 10 - Bulgaria: Production, Trade and Apparent Consumption of Crude Oil (Thousand Metric Tons) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	105	13578	471	13212
1986	93	13700	380	13413
1987	84	13219	289	13014
1988	77	12868	25	12920
1989	72	13729	1040	12771
1990	64	9948	1714	8298
1991	60	4400	0	4460
1992 <sup>a</sup>	60	2700	0	2760

<sup>a</sup> Estimate.

Source: Committee of Energy (Production); - PlanEcon Energy Report [1992/93]; own estimates [1992].

Table A 11 - Bulgaria: Production, Trade and Apparent Consumption of Natural Gas (Million Cubic Meters) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	20	5455	57	5418
1986	17	5680	54	5443
1987	13	6072	39	6046
1988	10	6251	23	6238
1989	9	6832	23	6818
1990	13	6832	5	6840
1991 <sup>a</sup>	12	5658	4	5666
1992 <sup>a</sup>	12	5250	3	5259

<sup>a</sup> Estimate.

Source: Committee of Energy (Production); - PlanEcon Energy Report [1992/93]; own estimates [1992].

Table A 12 - Bulgaria: Production, Trade and Apparent Consumption of Refined Oil Products (Thousand Metric Tons) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	127750	1990	2476	12264
1986	12800	1875	2439	12236
1987	12750	1775	2489	12036
1988	12650	1554	2360	11844
1989	13140	1514	2508	12146
1990	8100	1789	816	9073
1991	3700	1600	175	5125
1992 <sup>a</sup>	1950	1630	90	3490

<sup>a</sup> Estimate.

Source: Committee of Energy (Production); - PlanEcon Energy Report [1992/93]; own estimates [1992].

Table A 13 - Bulgaria: Production<sup>a</sup>, Trade and Apparent Consumption of Electricity (Million kWh) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	41629	7451	2956	46124
1986	41817	5427	1470	45774
1987	43470	5326	952	47844
1988	45036	5226	849	49413
1989	44328	5434	710	49052
1990	42130	5436	1656	45910
1991	38650	3716	1642	40724
1992 <sup>b</sup>	34304	2500	760	36044

a Primary and secondary electricity production;  
 b estimate.

Source: Committee of Energy (Production); - PlanEcon Energy Report (1992/93); own estimates (1992).

Table A 14 - Bulgaria: Average Annual Installed Capacity of Power Plants Belonging to the Committee of Energy (MW) 1988-1990

Power Plants	1988	1989	1990 <sup>a</sup>
Perva Komsomolska	500	350	170
Maritza-Istok 2	1020	1020	1178
Dimo Dichev	840	840	840
Bobov Dol	630	630	630
Republika	150	112	70
Pernik	25	25	25
Maritza-Istok 3	170	170	100
Avram Stoianov	30	30	30
Sofia	150	144	144
T. Kostov	175	186	186
Plovdiv	160	160	60
Varna	1260	1260	1260
Russe Istok	400	400	380
Russe Zapad	4	4	4
Kazaniak	12	12	12
Shumen	18	18	18
Gabrovo	18	18	18
Pleven	36	36	36
Total Thermal	5497	5314	5161
Total Hydro	1975	1975	1975
Total Nuclear	2760	2760	3760
Total Capacity	10232	10049	10896

<sup>a</sup> Revised data.

Source: Committee of Energy.

Table A 15 - Bulgaria: Capacity of Major Hydro Plants 1990

Plant	Installed Capacity (MW)	Net Head (m)	Discharge (m <sup>3</sup> /sec.)	No. of Sets	Average Annual Output (GWh)
Belmeken (pumped storage)	375.0/110.0	690.0	62.5	3+2	570.0
Sestrimo	240.0	534.0	56.6	2	265.0
Antonivanovtsi (pumped storage)	160.0	111.8	160.0	3+1	178.6
K. Georgiev	125.0	580.0	25.0	5	360.4
Mornina Klisura	120.0	251.0	5.6	3	181.0
Ivailovgrad	108.0	45.3	279.0	3	181.0
Kurdzhali	106.4	80.5	178.0	4	69.7
Krichim	80.0	162.0	61.0	2	166.8
Devin	80.0	138.0	72.8	2	132.5
Aleko	64.8	265.0	30.0	3	147.0
Studen Kladenets	60.0	59.5	120.0	4	194.5

Source: Committee of Energy.



Table A 16 - Bulgaria: Production, Trade and Apparent Consumption of Motor and Aviation Gasoline (Thousand Metric Tons) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	1684	90	740	1034
1986	1824	80	686	1218
1987	2029	63	854	1238
1988	2087	44	742	1389
1989	2166	20	850	1336
1990	1420	115	210	1325
1991 <sup>a</sup>	700	61	50	711
1992 <sup>a</sup>	560	40	40	560

<sup>a</sup> Estimate.

Source: Committee of Energy (Production); - PlanEcon Energy Report [1992/93]; own estimates [1992].

Table A 17 - Bulgaria: Production, Trade and Apparent Consumption of Gas-Diesel Oil (Thousand Metric Tons) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	4822	15	1601	3236
1986	4805	14	1540	3279
1987	4716	16	1530	3202
1988	4574	5	1520	3059
1989	4613	15	1542	3086
1990	2717	190	503	2404
1991 <sup>a</sup>	1300	336	100	1536
1992 <sup>a</sup>	560	320	60	820

<sup>a</sup> Estimate.

Source: Committee of Energy (Production); - PlanEcon Energy Report [1992/93]; own estimates [1992].

Table A 18 - Bulgaria: Production, Trade and Apparent Consumption of Fuel Oil (Thousand Metric Tons) 1985-1992

Year	Production	Imports	Exports	Apparent Consumption
1985	3730	1630	0	5360
1986	3546	1531	0	5077
1987	3570	1337	11	4896
1988	3698	1043	11	4730
1989	3823	994	9	4808
1990	2380	984	3	3361
1991	1000	853	0	1853
1992 <sup>a</sup>	440	1000	0	1440

<sup>a</sup> Estimate.

Source: Committee of Energy (Production); - PlanEcon Energy Report [1992/93]; own estimates [1992].

Table A 19 - Bulgaria: Energy Balance 1990 (Thousands of Tons of Coal Equivalent)

	Coal	Crude Oil	LPG	Gasoline	Diesel Fuel	Gas Oil	Heavy Fuel Oil	Kerosene	Other Petrol. Prod.	Natur. Gas	Hydro. Nucl. & Oth.	Electricity	Heat	Total
Domestic Production	7692	87								15	5898		0	13692
Imports	4714	12459		23	7		1199			7515	0	662	0	26578
Exports			-1	-278	-726		-11				0	-196	0	-1212
Stock Changes	70	-15	0	39	342	61	233	175		-63	0		0	843
Other				291	565	10	387	87						1341
<b>TOTAL INPUT</b>	12476	12531	-1	75	189	71	1808	262		7466	5898	466	0	41242
Petroleum Refineries	0	-12357	114	1946	2752	1205	3452	299	1616			-60		-874
Electricity & Heat Generation	-8089		0			-19	-893			-2712	-5898	5178	2278	-10155
Coal Mining and Transformation			0				76					-111	-242	-277
Own Uses & Losses	0			-29								-1114	-247	-1390
Other		-175	-5			-13	177			-15	0	0	0	-31
<b>TOTAL SUPPLY</b>	4387	0	108	1992	2942	1244	4619	561	1616	4740	0	4359	1789	28356
<b>TOTAL FINAL CONSUMPTION</b>	4387	0	109	1992	2942	1244	4619	561	1616	4739	0	4359	1789	28356
<b>TOTAL INDUSTRY</b>	2436	0	32	192	383	348	3809	0	1084	4695	0	2053	665	15696
Iron & Steel	1582		0		6					621	0	359	22	2589
Chemicals	489		1	14	23	31	1414		882	2646	0	657	107	6262
Non-Ferrous Metals	6		1		38		116			14	0	218	4	397
Construction Materials	115		0		42	38	244			859	0	143	19	1460
Glass	13		14			23	127			345	0	62	8	592
Metal Products & Engineering			15	38	50	80	305			80	0	266	112	945
Food, Drink & Tobacco	115		1	36	122	95	767			43	0	161	163	1505
Paper, Pulp & Printing	15		0				274				0	59	24	373
Wood & Wood Products	15		0	23	26		210				0	47	8	329
Textiles, Clothing & Leather	30		0			26	185				0	81	171	495
Industry n.e.s.	55		0	82	76	55	166		202	86	0		27	749
<b>TOTAL TRANSPORT</b>	8		0	194	1042	31	362	450			0	160	19	2266
<b>TOTAL OTHER</b>	1943	0	76	1503	1077	820	410	0	493	45	0	2145	1105	9616
Construction	11		1	186	328	54	82		493	11	0	110	37	1313
Agriculture	24			170	637	96	327						16	1270
Services and Other	823									25	0	416	368	1632
Households	1084		75	1148	112	670				9	0	1619	683	5400
NOT SPECIFIED	0	0	1	104	440	45	38	110	39	0	0	1	0	778

Source: Committee of Energy.

Table A 20 - Energy Balance 1991 (Source: Committee of Energy)

1991	Energy Balance (in 1000 tons of coal equivalent)					
	Hard coal	Brown coal lignite	Other primary solid fuels	Patent fuel, coke, other secondary solid fuels	Patent brown briquettes	Crude petroleum other inputs to petroleum refineries
1. Production of prim. energy	103.5	6613.3	279.9	0.0	0.0	80.6
2. Imports	3982.2	0.0	0.0	111.2	0.0	6419.4
3. Exports	0.0	0.0	-1.9	-6.4	0.0	0.0
4. Marine bunkering						
5. Changes in stocks	-83.1	43.0	3.5	90.3	8.0	-101.1
6. Gross consumption of primary energy	4002.6	6656.2	281.5	195.1	8.0	6399.0
7. Energy converted - Total	-3760.3	-6505.8	-43.1	437.1	825.2	-6434.4
Coal briquette plants		-881.1			825.2	
Coal coke plants	-889.2			631.6		
Gasworks						
Blast furnaces				-196.8		
Petroleum refineries						-6434.4
Public power plants	-1506.5	-4354.9	0.0			
Power plants of selfproduc.	-835.7	-83.2	-0.8			
Plants for comb. gener. of el. energy and heat	-419.7	-1145.7	0.0	0.0	0.0	0.0
Heating plants	-109.2	-41.0	-38.6	0.0	0.0	0.0
Other energy conversion industries			-3.7	2.3		
8. Transfers						
9. Consumption by energy producing industries						
10. Losses in transport and distribution	0.0	0.0	0.0	0.0	0.0	0.0
11. Non-energy use	0.0	0.0	0.0	0.0	0.0	0.0
12. Final consumption - Total	256.6	196.7	238.6	658.0	864.7	2.0
Manufact., mining and construction - Total	205.5	7.3	20.2	657.8	13.5	2.0
Steel industries			0.2	597.3	0.2	
Non-ferrous metal industr.	2.4	1.8	1.8	54.5		
Chemical industries	203.1		3.2	6.0	0.1	2.0
Other manuf. industries		5.4	15.0		13.2	
Transport - Total	4.8	4.4	1.1	0.0	1.9	0.0
Rail transport	4.2	3.9	0.2	0.0	1.3	0.0
Road transport	0.3	0.4	0.8	0.0	0.6	0.0
Waterway transport	0.4	0.1	0.0	0.0	0.0	0.0
Air transport	0.0	0.0	0.0	0.0	0.0	0.0
Households and other consumers - Total	46.3	185.1	217.3	0.1	849.3	0.0
Households	31.7	160.8	163.5	0.0	825.2	0.0
Agriculture, forestry	12.1	5.4	11.4	0.1	21.0	0.0
Trade	2.5	3.3	7.6	0.0	2.2	0.0
Other consumers	0.1	15.5	34.8	0.0	0.9	0.0
13. Statistical differences	-14.4	-46.4	-0.2	-25.8	-31.5	-37.4

Table A 20 - continued

1991	Energy Balance (in 1000 tons of coal equivalent)					
	Crude LPG and other petro- leum gases	Light petro- leum pro- ducts gases	Heavy petro- leum pro- ducts	Other petro- leum pro- ducts	Nat- ural gas	Other de- rived gases
1. Production of prim. energy					11.5	
2. Imports	0.0	362.7	2347.9		6394.0	0.0
3. Exports	0.0	-5.3	-17.7		0.0	0.0
4. Marine bunkering						
5. Changes in stocks	3.5	393.2	92.4		164.3	0.0
6. Gross consumption of primary energy	3.5	750.7	2422.6	0.0	6569.8	0.0
7. Energy converted - Total	320.9	1731.8	664.3	114.4	-3634.6	211.2
Coal briquette plants						
Coal coke plants						140.1
Gasworks						
Blast furnaces						196.8
Petroleum refineries	357.2	1925.6	3878.3	114.4		
Public power plants	0.0	0.0	-61.4		-453.0	0.0
Power plants of selfproduc.	-36.4	0.0	-722.9		-1461.5	-125.6
Plants for comb. gener. of el. energy and heat	0.0	-3.3	-367.3		-1357.5	0.0
Heating plants	0.0	-190.5	-2082.5		-362.6	0.0
Other energy conversion industries						
8. Transfers						
9. Consumption by energy produ- cing industries						
10. Losses in transport and distribution	-1.6	0.0	0.0		0.0	-18.8
11. Non-energy use	-248.2	-695.8	-118.3	-114.4	-476.1	-192.4
12. Final consumption - Total	73.9	1787.2	3006.8	0.0	2406.0	0.0
Manufact., mining and construction - Total	30.0	183.4	605.5		2314.8	0.0
Steel industries		1.4	12.2		214.2	
Non-ferrous metal industr.	0.9	7.8	128.2		10.2	
Chemical industries	1.3	33.7	14.7		1361.6	
Other manuf. industries	27.8	140.5	449.8		728.8	
Transport - Total	0.0	368.5	1009.3	0.0	0.0	0.0
Rail transport	0.0	5.8	108.1		0.0	0.0
Road transport	0.0	78.0	518.8		0.0	0.0
Waterway transport	0.0	0.1	380.5		0.0	0.0
Air transport	0.0	284.5	2.0		0.0	0.0
Households and other consumers - Total	43.9	1235.3	1391.9	0.0	91.2	0.0
Households	43.9	728.4	164.0		0.0	0.0
Agriculture, forestry	0.0	185.9	759.9		25.3	0.0
Trade	0.0	102.4	44.9		3.9	0.0
Other consumers	0.0	218.6	423.1		62.0	0.0
13. Statistical differences	0.6	-0.5	-38.2	0.0	53.0	0.0

Table A 20 - continued

1991	Energy Balance (in 1000 tons of coal equivalent)						Total	
	Nuclear hydro- and geo-thermal energy in conv. fuel equival.	Nuclear energy physical energy input	Hydro- and geo-thermal energy in physical energy input	Elec- tric energy	Steam and hot water other n.e.s.	Energy in con- vention- al fuel equi- valent	Energy in phy- sical energy input	
1. Production of prim. energy	6022.7	1619.4	299.9	0.0		13111.4	9008.0	
2. Imports				456.5		20073.9	20073.9	
3. Exports				-201.8		-233.0	-233.0	
4. Marine bunkering						0.0	0.0	
5. Changes in stocks						614.1	614.1	
6. Gross consumption of primary energy	6022.7	1619.4	299.9	254.7	0.0	33566.4	29463.0	
7. Energy converted - Total	-6022.7	-1619.4	-299.9	4781.1	6268.5	-11046.5	-6943.0	
Coal briquette plants						-55.9	-55.9	
Coal coke plants						-117.6	-117.6	
Gasworks						0.0	0.0	
Blast furnaces						0.0	0.0	
Petroleum refineries						-138.8	-138.8	
Public power plants	-5984.3	-1619.4	-299.9	3913.1		-8447.0	-4382.0	
Power plants of selfproduc.				446.2	2127.5	-692.4	-692.4	
Plants for comb. gener. of el. energy and heat				421.8	1638.9	-1232.7	-1232.7	
Heating plants	-38.4				2502.1	-360.7	-322.3	
Other energy conversion industries						-1.4	-1.4	
8. Transfers						0.0	0.0	
9. Consumption by energy producing industries				-516.5		-516.5	-516.5	
10. Losses in transport and distribution				-655.9	-304.2	-980.6	-980.6	
11. Non-energy use						-1845.3	-1845.3	
12. Final consumption - Total	0.0	0.0	0.0	3863.4	5964.4	19318.2	19318.2	
Manufact., mining and construction - Total				2082.8	4578.5	10701.3		
Steel industries				284.6	145.9	1256.0		
Non-ferrous metal industr.				189.0	70.8	467.4		
Chemical industries				554.5	1844.3	4024.5		
Other manuf. industries				1054.7	2517.5	4952.8		
Transport - Total	0.0	0.0	0.0	126.9	21.5	1538.3		
Rail transport				101.9	9.4	235.0		
Road transport				21.9	11.2	632.0		
Waterway transport				0.8	0.6	382.5		
Air transport				2.2	0.3	289.0		
Households and other consumers - Total	0.0	0.0	0.0	1653.7	1364.4	7078.6		
Households				1278.0	908.2	4303.7		
Agriculture, forestry				106.4	214.0	1341.4		
Trade				77.1	42.0	286.0		
Other consumers				192.2	200.2	1147.5		
13. Statistical differences	0.0	0.0	0.0	0.0	0.0	-140.8	-140.8	

Table A 21 - Energy Balance 1991 (Source: Committee of Energy)

1991	Energy Balance (in tons of oil equivalent)					
	Hard coal	Brown coal lignite	Other primary solid fuels	Patent fuel, coke, other secondary solid fuels	Patent brown coal briquettes	Crude petroleum other inputs to petroleum refineries
1. Production of prim. energy	72425	4629290	195898	0	0	56422
2. Imports	2787526	0	14	77834	0	4493610
3. Exports	0	0	-1359	-4467	0	0
4. Marine bunkering						
5. Changes in stocks	-58160	30070	2476	63207	5598	-70744
6. Gross consumption of primary energy	2801792	4659360	197029	136574	5598	4479287
7. Energy converted - Total	-2632232	-4554071	-30156	305949	577646	-4504082
Coal briquette plants		-616770			577646	
Coal coke plants	-622426			442087		
Gasworks						
Blast furnaces				-137740		
Petroleum refineries						-4504082
Public power plants	-1054562	-3048422	0			
Power plants of selfprod.	-585004	-58220	-549			
Plants for comb. gener. of el. energy and heat	-293806	-801963	0	0	0	0
Heating plants	-76434	-28717	-27017	0	0	0
Other energy conversion industries			-2590	1602		
8. Transfers						
9. Consumption by energy producing industries						
10. Losses in transport and distribution	0	0	0	0	0	0
11. Non-energy use	0	0	0	0	0	0
12. Final consumption - Total	179622	137722	166996	460566	605278	1398
Manufact., mining and construction - Total	143832	5109	14142	460469	9420	1398
Steel industries			140	418110	140	
Non-ferrous metal industr.	1680	1260	1260	38150		
Chemical industries	142153		2240	4209	70	1399
Other manuf. industries		3800	10503		9210	
Transport - Total	3389	3058	737	4	1334	0
Rail transport	2927	2716	162	4	921	0
Road transport	194	267	573	0	413	0
Waterway transport	267	76	2	0	0	0
Air transport	0	0	0	0	0	0
Households and other consumers - Total	32401	129555	152116	94	594524	0
Households	22158	112582	114416	0	577646	0
Agriculture, forestry	8438	3782	7988	74	14700	0
Trade	1721	2343	5341	20	1524	0
Other consumers	84	10849	24371	0	655	0
13. Statistical differences	-10063	-32454	-123	-18044	-22035	-26193



Table A 21 - continued

1991	Energy Balance (in tons of oil equivalent)					
	Crude LPG and other petro- leum gases	Light petro- leum pro- ducts gases	Heavy petro- leum pro- ducts	Other pe- tro- leum pro- ducts	Nat- ural gas	Other de- rived gases
1. Production of prim. energy					8052	
2. Imports	0	253917	1643519		4475773	0
3. Exports	0	-3679	-12394		0	0
4. Marine bunkering						
5. Changes in stocks	2464	275243	64696		115038	0
6. Gross consumption of primary energy	2464	525481	1695821	0	4598864	0
7. Energy converted - Total	224601	1212293	465005	80080	-2544254	147873
Coal briquette plants						
Coal coke plants						98038
Gasworks						
Blast furnaces						137740
Petroleum refineries	250067	1347941	278841	80080		
Public power plants	0	0	-42968		-317097	0
Power plants of selfproduc.	-25466	18	-506048		-1023080	-87905
Plants for comb. gener. of el. energy and heat	0	-2303	-257080		-950257	0
Heating plants	0	-133363	-1457739		-253819	0
Other energy conversion industries						
8. Transfers						
9. Consumption by energy pro- ducing industries						
10. Losses in transport and distribution	-1154	-14	0		0	-13171
11. Non-energy use	-173750	-487059	-82837	-80080	-333293	-134702
12. Final consumption - Total	51711	1251063	2104753	0	1684225	0
Manufact., mining and construction - Total	20967	128398	423878		1620390	0
Steel industries		980	8540		149940	
Non-ferrous metal industr.	630	5460	89740		7140	
Chemical industries	910	23590	10290		953120	
Other manuf. industries	19426	98368	314888		510190	
Transport - Total	34	257921	706521	0	0	0
Rail transport	2	4089	75691		0	0
Road transport	31	54598	363140		0	0
Waterway transport	0	86	266325		0	0
Air transport	0	199149	1365		0	0
Households and other consumers - Total	30711	864744	974354	0	63834	0
Households	30698	509890	114826		0	0
Agriculture, forestry	0	130110	531938		17678	0
Trade	1	71695	31440		2753	0
Other consumers	12	153049	296151		43403	0
13. Statistical differences	450	-362	-26764	0	37092	0

Table A 21 - continued

1991	Energy Balance (in tons of oil equivalent)						Total	
	Nuclear hydro- and geo-thermal energy in conv. fuel equival.	Nuclear energy physical energy input	Hydro- and geo-thermal energy in physical energy input	Elec- tric energy	Steam and hot water other n.e.s.	Energy in con- ventional fuel equi- valent	Energy in phy- sical energy input	
1. Production of prim. energy	4215886	1133578	209912	0		9177973	6305577	
2. Imports				319545		14051738	14051738	
3. Exports				-141231		-163130	-163130	
4. Marine bunkering						0	0	
5. Changes in stocks						429888	429888	
6. Gross consumption of primary energy	4215886	1133578	209912	178314	0	23496469	20624073	
7. Energy converted - Total	-4215890	-1133578	-209912	3346770	4387971	-7732517	-4860117	
Coal briquette plants						-39124	-39124	
Coal coke plants						-82301	-82301	
Gasworks						0	0	
Blast furnaces						0	0	
Petroleum refineries						-97153	-97153	
Public power plants	-4189010	-1133578	-209912	2739170		-5912889	-3067369	
Power plants of selfproduc.				312340	1489250	-484663	-484663	
Plants for comb. gener. of el. energy and heat				295260	1147262	-862888	-862888	
Heating plants	-26880				1751459	-252511	-225631	
Other energy conversion industries						-988	-988	
8. Transfers						0	0	
9. Consumption by energy producing industries				-361550		-361550	-361550	
10. Losses in transport and distribution				-459160	-212922	-686421	-686421	
11. Non-energy use						-1291722	-1291722	
12. Final consumption - Total	0	0	0	2704374	4175049	13522759	13522759	
Manufact., mining and construction - Total				1457965	3204967	7490937		
Steel industries				199220	102130	879200		
Non-ferrous metal industr.				132300	49560	327180		
Chemical industries				388150	1291010	2817140		
Other manuf. industries				738295	1762267	3466947		
Transport - Total	0	0	0	88817	15019	1076833		
Rail transport				71154	6601	164466		
Road transport				15325	7829	442371		
Waterway transport				580	387	267723		
Air transport				1558	202	202274		
Households and other consumers - Total	0	0	0	1157591	955063	4954988		
Households				894626	635738	3012579		
Agriculture, forestry				74463	149780	938950		
Trade				53929	29433	200199		
Other consumers				134574	140113	803260		
13. Statistical differences	-4	0	0	0	0	-98500	-98495	

Table A 22 - Bulgaria: Selected Electricity Prices (Leva/kWh) 1980-1992

1. Households	1980	1985	1990	1991 <sup>a</sup>	1991 <sup>b</sup>	1992 <sup>c</sup>
- Day time	0.034	0.045	0.045	0.167	0.284	0.383
- Night time	0.012	0.020	0.020	0.088	0.150	0.203
2. Industry and Government		Winter Tension			Summer Tension	
1992 <sup>c</sup>	High	Medium	Low	High	Medium	Low
- Day time						
Peak	1.268	1.315	1.377	1.106	1.141	1.197
Other	0.688	0.712	0.744	0.595	0.617	0.646
- Night time	0.340	0.351	0.368	0.293	0.303	0.318
<sup>a</sup> February;						
<sup>b</sup> June;						
<sup>c</sup> May.						

Source: Committee of Energy.

Table A 23 - Reducing Global Carbon Emissions with Alternative Policy Instruments over the Period 1990-2050 (Simulation Results)

Region	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
	Business as usual	Carbon tax in OECD countries	Energy cum Carbon tax in EC countries	Toronto Agreement	Liberalisation of energy prices
	CO <sub>2</sub> emissions in 2050 (million t of carbon)			Cut in CO <sub>2</sub> emissions in 2050 <sup>b</sup> (per cent)	
CEECs <sup>a</sup>	909	0	0	-42	-44
Former USSR	2394	0	0	-37	-17
EC	1273	-36	-38	-49	25
USA	2295	-42	0	-53	1
World	18998	-11	-3	-64	-20

<sup>a</sup> Central and Eastern European Countries;  
<sup>b</sup> Relative to Scenario 1.

Source: Burniaux et al. [1992], Tables 2-9.

Table A 24 - Costs and Benefits of Global Carbon Emission Reduction in Alternative Policy Scenarios, 1990 - 2050 (Simulation Results)<sup>a</sup>

Region	Scenario 2 Carbon tax in OECD countries	Scenario 3 Energy cum carbon tax in EC countries	Scenario 4 Toronto Agreement	Scenario 5 Liberalisation of energy prices
CEECs <sup>b</sup>	0.2	0.1	0.5	1.1 <sup>c</sup>
Former USSR	0	0	-0.2	
EC	-0.3	-0.6	-0.8	0.1 <sup>d</sup>
USA	-0.3	0	-0.8	
World	-0.3	-0.1	-1.4	0.5 <sup>e</sup>

<sup>a</sup> Real GDP changes relative to the business as usual scenario (in per cent);  
<sup>b</sup> Central and Eastern European Countries;  
<sup>c</sup> Changes in the present value of real household income of non-OECD countries over the period 1995 - 2050, relative to the business as usual scenario;  
<sup>d</sup> as in footnote c but for OECD countries;  
<sup>e</sup> as in footnote c but for all countries.

Source: Burniaux et al. [1992], Tables 2-9.