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Energy Policy in Transitional Economies: The Case of Bulgaria

by Federico Foders

CONTENTS

- For several decades, the countries in Central and Eastern Europe pursued an energy-intensive strategy of economic development based on distorted relative prices of energy. This typical feature of central planning created the illusion of a virtually unlimited supply of energy. The illusion came to an end in the 1980s, when the widening gap between energy supply and energy demand faced by the region led to a severe energy crisis.
- Bulgaria is one of the countries most affected by the energy crisis in Central and Eastern Europe. Poorly endowed with energy resources, Bulgaria relies largely on international trade to satisfy its demand for energy. During Bulgaria's membership in the CMEA, energy-intensive growth resulted in a strong dependency on only one energy exporter, the former Soviet Union. With the CMEA's dissolution, Bulgaria was left to design and implement a new energy policy as a part of its own efforts to transform its economy into a market economy.
- In spite of the far-reaching liberalization of prices experienced by Bulgaria in 1991, economic transition has been rather slow and energy reform has been neglected. Domestic energy prices have remained under government control, and energy prices have been falling in real terms due to the high overall inflation. Domestically produced primary energy is not priced at international levels, and consumer prices for final energy do not reflect domestic production costs. Moreover, current energy pricing favours small-scale users (households) and discriminates against large-scale users (industry). The continuing high level of energy consumption and the prevailing fuel mix (oil products and lignite) have a particularly adverse effect on the environment in terms of SO_2 and CO_2 emissions.
- In the short run, energy policy should concentrate on the liberalization of domestic energy prices. Primary energy should be priced at world market prices and final energy at marginal costs. A realistic valuation of energy products will support the structural change component of the transformation process and increase energy efficiency in Bulgaria. A policy of fuel diversification complemented by one of regional diversification of energy imports will constitute the best long-run hedge against the risk of supply disruptions. Energy utilities should be privatized, and foreign companies should be allowed to play a leading role in the modernization of the energy sector. The Bulgarian government should create optimal conditions for cooperating closely with EC member countries in the field of energy, as already delineated in the European Energy Charter and in Bulgaria's Association Treaty with the EC. As long as sophisticated emission fees can be neither implemented nor enforced, energy-related environmental pollution should be dealt with by taxing energy use at the consumer level with a simple uniform ad valorem rate applied to all fuels.

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A first draft of this paper was prepared as part of a research project conducted in the framework of the European Communities' 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, the Netherlands, and the Kiel Institute of World Economics, Kiel, Germany (project coordinator). The project was entitled "Structural Change in the Bulgarian Energy Sector: Energy and Environmental Policy Options for Bulgaria and Opportunities for Cooperation with the EC". The following economists participated in the project: Dr. Ludmilla Dudova, Dr. Ingrid Shikova, Dr. Marguerita Shivergeva, Dr. Georgi Tzekin (Sofia), Professor Alexander Kemp (Aberdeen), Dr. Jan Hoogland (Rotterdam) and Dr. Federico Foders (Kiel). Dr. Federico Foders also served as rapporteur.

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I. Introduction

Shortly after they embarked on the transformation of their centrally planned economies into market economies, the governments of Central and Eastern Europe became aware of the close interdependence between energy sector reforms and the general transformation process. Centralized decision-making on energy supply and allocation had been the cornerstone of central planning: abundant and cheap energy had been assumed to be the second most important ingredient of economic growth, capital being the most important. 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 constitutes 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 member countries of the Council for Mutual Economic Assistance (CMEA) regarding energy imports from mainly one source, the former Soviet Union, 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 Soviet Union, 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.

Since the dissolution of the CMEA at the turn of the decade, the burden of adjustment in the energy sector has had to be borne primarily by the energy-poor, former CMEA member countries rather than by the Russian Federation and some other energy-rich newly independent states (NIS). Not surprisingly, energy sector re-

form 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 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 Soviet Union.

A word on the quality and availability of Bulgarian economic statistics should be in order here. Whereas official Bulgarian statistics for the 1970s and 1980s are generally unreliable, recent statistics are, in part, not available, following the reorganization 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*, the United States Central Intelligence Agency's *Handbook of Economic Statistics* and the OECD's Centre for Co-Operation with European Economies in Transition data bank of *Short-Term Economic Indicators, Central and Eastern Europe*, 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 *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 fell by about 24 per cent between December 1990 and December 1991 and by about 40 per cent between December 1990 and December 1992 [OECD, CCEET, 1993]. On average, consumer prices increased by some 5 per cent per month (which corresponds to an annualized rate of 80 per cent) during the period January–December 1992; at the end of December 1992, almost 580,000 persons were unemployed (14.8 per cent of the labour force) [PlanEcon, a, 1993]. After having already contracted in 1990 and 1991, Bulgaria's real gross domestic product (GDP) faced another dramatic drop due to recession-cum-inflation in 1992 (Table 1). 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$2,060 (Algeria) and US$2,370 (Argentina); the estimate for Bulgaria is US$2,250, which is higher than Poland's (US$1,690) and Romania's (US$1,640) and which amounts to no more than 10 per cent of the per capita income of the United States at current exchange rates [World Bank, b, 1992].

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 industrialization and 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.

Table 1 — Real GDP Growth in Central and Eastern Europe, 1961–1992 (per cent)

	1961–70[a,b]	1971–80[a,b]	1981–89[a,c]	1990[c,d]	1991[c,d]	1992[d,e]
Bulgaria	5.8	2.8	0.8	–9.1[f]	–12.0[f]	–7.7
Czechoslovakia	2.9	2.8	1.4	–0.4	–16.0	–6.8
Hungary	3.4	2.6	0.8	–3.3	–10.0	–5.0
Poland	4.2	3.6	0.5	–11.6	–9.0	1.0
Romania	5.2	5.3	–0.1	–5.6	–15.0	–15.4
Average[g]	4.3	3.4	0.7	–6.0	–12.4	–6.8

[a]Average annual rates. — [b]Central Intelligence Agency [1990]. — [c]PlanEcon [c, 1991, 1992]. — [d]Annual changes. — [e]Own estimates. — [f]World Bank [c]. — [g]Unweighted.

Since economic growth was driven primarily by an expansion of industry, particularly of heavy industry, there are two plausible hypotheses explaining Bulgaria's adverse development after 1970. First, import substitution in Bulgaria had already reached its limits in the late 1960s. Second, neither the existing division of labour within the CMEA nor the rate and quality of technological progress achieved in the Soviet Union (the region's technological leader) offered new possibilities for industrial growth in Bulgaria. As a small, resource-poor country with a population of 8.99 million,[1] exports constituted a necessary outlet for Bulgaria's industry. Export expansion, however, was constrained for two reasons: on the one hand, the absorption capacity of CMEA member countries for Bulgarian exports had diminished, because Bulgaria had begun to run an increasing trade surplus with CMEA member countries in the 1980s; on the other hand, an increasing deficit with Western countries indicated that Bulgarian products were loosing 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 of the Soviet technology trap. The disintegration of the CMEA has only worsened the situation.

A glance at the growth performance of Central and Eastern European countries (Table 1) shows that in recent decades Bulgaria experienced rates that were not only much lower than its own historical record, but also lower than the rates achieved by other countries in the region. Having led regional economic growth in the 1960s, Bulgaria suffered the severest slowdown in the region thereafter, and it suffered a contraction of real GDP in the early 1990s that was second only to the contraction in Romania.

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 (Table 2). The country's comparative advantage was founded on its continental climate and fertile soil. Industry provided only 15 per cent of the total output. The importance of both sectors almost reversed between 1939 and 1991. Interestingly, agriculture reached its lowest share in 1989 and started to recover 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. Bulgaria's industrial sector also seems to be oversized compared to other lower-middle-income countries, such as Algeria, Malaysia and Argentina, which, like Bulgaria, pursued an culture industrialization strategy based on a forced reallocation of production factors away from agricul-

Table 2 — Economic Structure in Bulgaria, 1939–1991 (per cent)[a]

	Agriculture[b]	Industry[c]	Construction	Transport[d]	Trade	Other
1939	65.0	15.0	5.0[e]	4.0[e]	10.8[e]	3.0[e]
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
1991	28.8	47.0	4.9	9.1	9.2	1.0

[a]Contribution to the net material product. — [b]Includes forestry. — [c]Includes mining and energy. — [d]Includes communications. — [e]Own estimates.

Source: Economist Intelligence Unit [a; b, 1992, 1993]; own estimates.

ture towards industry. Bulgaria's services sector appears to be much smaller than the one typical for a lower-middle-income market economy.

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 accounts for a quarter of total industrial output, which is 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 low production of durable consumer goods and of capital goods for the production of durable consumer goods in this country.

Imbalances in the economic structure also exist in the geographical pattern of production. Industrial plants are generally concentrated in urban areas, where the centralized 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 led to negative externalities in terms of environmental damage and to 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 at 96 per cent (1990) and 35 per cent (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, b, 1992]. 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-à-vis the US dollar between January 1990 (leva 2.02/US$) and December 1991 (leva 17.51/US$) and (iii) the development of cross rates (leva-ruble-dollar) during this period. Moreover, it is possible that price changes for tradables in the ruble area had an impact. Although, at this point, it is neither possible to clearly identify the nature of all the relevant factors nor to determine the actual weight of individual factors, the combined effect of these factors on Bulgarian foreign trade can be read-

Table 3 — Bulgarian Foreign Trade by Currency Areas, 1990 and 1991 (estimates)

	1990		1991	
	customs statistics	payments statistics	customs statistics	payments statistics
	US$ million			
Exports	8514	8458	3433	4366
Convertible currency	2627	2615	2734	3737
Former CMEA	na	na	1349	1352
West	2627	2615	1385	2385
Ruble	5887	5843	699	629
Imports	10491	10798	2700	4114
Convertible currency	3101	3372	2330	3781
Former CMEA	na	na	1040	1302
West	3101	3372	1290	2479
Ruble	7390	7426	370	333
Trade indicators[a]	Per cent			
Exports/GDP	43	43	20	25
Imports/GDP	53	55	15	24
(Exports + imports)/GDP	96	97	35	49

[a]Assumptions: GDP for 1990 estimated at US$19,800 million [World Bank, c] and for 1991 at US$17,424 million (decrease of 12 per cent).

Source: PlanEcon [c, 1992]; World Bank [c]; own estimates and calculations.

ily 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 that almost doubled the share of trade (exports plus imports) with the West in total Bulgarian foreign trade. Nevertheless, the former CMEA member countries remained the largest destination and origin of Bulgarian trade flows in 1991, with the former Soviet Union remaining the largest single trade partner (Table A2). While the relative shares of both exports to and imports from EFTA member countries and the United States 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 remained Bulgaria's single largest partner in the EC. The relative share of trade with less developed countries (LDCs) also benefited from the breakdown of intra-CMEA trade.

The shifts in the regional structure of Bulgarian's foreign trade that ocurred in 1990 and 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[2] (Table A3). Fuels, minerals and metals, which amounted to "only" about 34 per cent of total imports in 1990, accounted for about 59 per cent of total imports in 1991, largely as a result of fuels being valued 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 restric-

tions, 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 non-private, and all importers enjoy unlimited access to foreign exchange in the wake of introducing 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.

The relative share of Bulgarian trade with the OECD member countries and LDCs seems to have benefited from the collapse of the CMEA. However, Bulgaria has been running a mounting deficit in its convertible-currency current account, and, therefore, Bulgaria's ability to create and expand trade with the West will be limited by its ability to cope with the payments problems associated with its 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's total debt accounted for around 152 per cent of GNP and 238 per cent of the country's convertible-currency exports (Table A4), putting Bulgaria in a weaker position in this respect than other highly indebted countries (e.g. Poland, Hungary and Algeria). The size of the debt is related to the fact that Bulgaria financed its growing deficit in the convertible-currency current account in the 1980s (especially after the mid-1980s) primarily with credits with short maturities from Western commercial banks and is now facing an extraordinary debt service burden. Although the Bulgarian government suspended payments of principal in March and debt service in June 1990, ongoing negotiations with the London Club of commercial bank creditors could help to restore Bulgaria's access to the international capital markets soon.[3] 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. However, the future of debt negotiations will depend on the developments of the relations between the Bulgarian government and the International Monetary Fund (IMF), which are particularly influenced by the government's acceptance of economic targets requested by the IMF. Since the bulk of Bulgaria's foreign debt is owed to commercial banks, debt relief schemes to reduce the foreign debt following the Brady Plan for Latin America will be unlikely to be viable for Bulgaria.

4. Economic Policy

Bulgaria experienced its Big Bang in early 1991, when prices for all goods excluding basic food products and energy were liberalized. 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 hand. The prices for coal, district heating and electricity for households have remained heavily subsidized. The prices for 7 out of the 14 goods classified as essential and formerly administered by the government were liberalized in May 1992.

The Big Bang brought about a shift in the consumer price index as well as real wage losses during 1991; the central bank largely accommodated the price increase by expanding the money supply. The real interest rate was negative[4] and the supply of money (as measured by M1) continued to expand 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 tendency towards higher inflation rates is revealed by the rate of change of the real narrow money measure, which fell drastically during the Big Bang and was generally

unstable in 1991 and 1992 [PlanEcon, c, October 1993].

The system of multiple exchange rates was substituted by a unified rate, floating vis-à-vis all other currencies, and partial internal convertibility. Given that the real exchange rate appreciated almost every month from March 1991 to December 1992, contributing to an overvaluation of the domestic currency [ibid.], 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, fiscal revenues were much lower than expected because of the serious decline in economic activity experienced in 1990 and 1991, so that the deficit remained at some 7 per cent, albeit improving somewhat towards the end of the year [World Bank, c]; interest payments accounted for about a third of government expenditures in 1991.[5]

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 privatization legislation has been finally adopted (Bulgaria is the last of the Eastern European countries to privatize), and the government has already set up an agency similar to the German Treuhandanstalt to administer privatization projects. In many aspects, the Bulgarian privatization law resembles the laws passed in Hungary and Poland, which is to say that the voucher or mass privatization option has been definitively rejected. The new constitution endorses private property, and the new company law offers a wide array of organizational possibilities for private economic activities. Other important laws (concerning e.g. taxation, securities, bankruptcy and intellectual property) are currently being prepared. However, the state is still running about 90 per cent of the economy, although the World Bank reports that more than 170,000 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 [ibid.].

Small scale privatization began in 1991 and affected some 70 shops and petrol stations. Moreover, restitution of agricultural land was launched during this year. In 1992, a new drive in privatization and restitution in urban areas was introduced and a new general law and amendments to older laws were passed. The new law governs not only small but also large scale privatization, concerning the auctioning of enterprises with a book value of leva 10 to 200 million (about US$0.5 to 10 million) by the privatization agency. Therefore, in a first step, chartered accountants have to value all enterprises; employees may buy up to 20 per cent of non-voting shares at a discount. The agency is responsible for the privatization of 8,000 major firms, whereas ministries privatize small and middle-sized firms directly. 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 privatization.[6] The agency aims mainly at attracting foreign buyers, but subsidized credit shall be available for potential domestic buyers.

Several problems, however, remain unsolved. Old enterprise debt (government debt and interfirm debt) still needs to be dealt with. The planned privatization scheme seems to be geared toward foreign capital; there is still no local capital market to mobilize 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.

Demonopolization is also under way 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; the government retains share ownership until privatization takes place. The same procedure is applied in agro-industry. In some of the cases in which demonopolization 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 privatization schemes and the establishment of a local capital market in order to mobilize domestic savings [OECD, CCEET, 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 Section II.4; this section focuses 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 respect to this country's international competitiveness in hard-currency trade. Vis-à-vis the United States, the technological leader of the West, the catching-up potential of Bulgaria seems to be similar to the one of other Eastern European countries and other lower-middle-income countries. Comparing GDPs across countries, however, in 1990 Bulgaria's per capita income exceeded Hungary's, Poland's, Romania's, Algeria's and Argentina's per capita income (Table 4). Hence, according to the catching-up hypothesis,[7] the speed with which Hungary, Poland, Romania, Algeria and Argentina converge to the income level of the United States could be higher than for Bulgaria.

Table 4 — Catching-up Potential[a] of Central and Eastern Europe and Lower-Middle-Income Countries, 1990 (per cent)

	1990
Bulgaria	27.8
Czechoslovakia	30.0[b]
Hungary	21.8
Poland	15.9
Romania	23.8
Eastern Europe[c]	23.9
Algeria	21.9
Malaysia	37.0
Argentina	21.9
Lower-middle-income countries[c]	27.2

[a]Measured as a country's real GDP per capita as a percentage of the real GDP per capita of the United States (=100). International comparability of real GDP has been achieved using purchasing 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. — [b]Own estimates. — [c]Unweighted averages. The average for the lower-middle-income countries includes Bulgaria.

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

The international specialization of Bulgaria can be inferred from the indicator of revealed comparative advantage (RCA), as shown in Table 5. This indicator shows whether a country is competitive (RCA positive) or not (RCA negative) in international trade with respect to a specific product group. Bulgaria was competitive in its trade with OECD member countries in raw-material-intensive products (in 1970, 1980 and 1988), in labour-intensive products and in capital-intensive products (in 1988). Vis-à-vis OECD member countries, Bulgaria's comparative disadvantage showed up in R&D-intensive products. This can be interpreted as a result of the heavy systemic distortions in the Bulgarian economy from 1946 to 1988. According to the factor proportions hypothesis of international trade, the relatively abundant factors determined Bulgaria's international position; this abundance, however, was not the result of the market but artificial. Since abundance and scarcity are economic concepts and depend on the correct valuation of physical

Table 5 — RCA[a] of Bulgaria and Asian NICs in Foreign Trade with OECD Member Countries by Product Groups, 1970, 1980 and 1988 (per cent)

	Raw-material-intensive products[b]	Labour-intensive products[c]	Capital-intensive products[d]	R&D-intensive products	
				easy to imitate products[e]	difficult to imitate products[f]
Bulgaria					
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
Asian NICs[g]					
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

[a]Revealed comparative advantage; calculated with OECD foreign trade statistics using the formula: ln $[(x_i/X)/(m_i/M)]$, with x_i, m_i: exports (imports) of product group i and X, M: total exports (imports). — [b]SITC 0,2 (excl. 26), 3 (excl. 35), 4, 56. — [c]SITC 26, 6 (excl. 62, 67, 68), 8 (excl. 87, 88). — [d]SITC 1, 35, 53, 55, 62, 67, 68, 78. — [e]SITC 51, 52, 54, 58, 59, 75, 76. — [f]SITC 57, 7 (excl. 75, 76, 78), 87, 88. — [g]Hong Kong, Malaysia, Singapore, South Korea, Taiwan.

Source: Heitger et al. [1992, Table 21, p. 51].

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 a resource-intensive structure of production might not be viable anymore. To the extent that the current international position of the newly industrializing countries (NICs) of South-East Asia constitute a prediction of the future profile of comparative advantage of Eastern European countries, it can be hypothesized that the comparative advantage of a transformed Eastern Europe shifts away from resource-intensive products towards labour-intensive products and easy to imitate R&D-intensive products (Table 5).

The third factor potentially influencing the future role of Bulgaria in the world economy is the expected development of the *international environment*. Table 6 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 remained unsolved [OECD,

Table 6 — Forecasts for the World Economy, 1990–2000 (per cent)[a]

	Trend	World Bank		Project Link	WEFA group	DRI
		A	B			
	1965–1989	1990–2000		1991–1995		
OECD countries						
Real GDP growth	3.1	2.9	2.2	2.8	3.2	3.1
Real interest rate	3.1	3.4	5.1	4.0	4.3	4.9
World export growth	4.1	5.8	4.5	5.6	4.3	na
Change in the real price of oil	9.3	–0.6	0.9	0.9	0.8	–2.0

[a]Average annual rates.

Source: World Bank [b, 1991].

CCEET, 1992]. It could also imply that foreign direct investment is bound to be scarce in Bulgaria during the 1990s and that only the most attractive locations in the world will see capital inflows. Bulgaria will have to become competitive as a location of economic activity, in order to create the necessary conditions for future structural change and growth on the basis of Western technology.

Relatively low oil prices are good news to a country like Bulgaria, which has 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 12 per cent in 1991 and of 7.7 per cent in 1992 (Table 1), the Bulgarian economy will recover only slowly during the first half of the 1990s; higher growth rates should be unlikely before 1995. The foreign exchange constraint, 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, which is dependent on the country's capacity to import new machines and equipment from the West, conservative forecasts reasonably see growth of 2 to 3 per cent per year taking place towards the second half of the 1990s (Table 7).

Table 7 — Forecasts for Bulgarian Real GDP Growth, 1992–2000 (per cent)

Scenario	1993	1994	1992–2000
Low	1.0[a]	2.0[a,b]	2.0[b] to 3.0[a]
High	2.0[b] to 5.0[c]	5.5[c]	5.1[c]

[a]Own estimates. — [b]OECD, CCEET [1992]. — [c]World Bank [c].

III. Energy Supply and Demand[8]

1. Resource Endowment and Domestic Production of Primary Energy

Bulgaria has only very few valuable domestic energy resources. Proven oil and gas reserves, which were 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 accounted in 1991 for 53 per cent of the domestic production of primary energy; it is followed by nuclear power and hydropower (46 per cent) (Table A14).

Lignite reserves (2,350 million tonnes were considered to be minable at current domestic prices and technology in 1990) are concentrated in one site, the open-pit deposit of Maritza-East. Supposing the present production rate were maintained, these reserves could last for about 85 years. Sub-bituminous (210 million tonnes), bituminous (10 million tonnes) and anthracite (1 million tonnes) coal reserves are not only small but also probably not economically recoverable. Also, a recent discovery of hard coal in Northeast Bulgaria, lying at an average depth of around 2,000 m, might not be commercially recoverable. Furthermore, whereas lignite has an extremely low heating value (about 2.7 times lower than anthracite) and a high ash and sulphur content, sub-bituminous coal has a high ash content.

The production of all coal types has declined in recent years, with the production of anthracite declining most (Table A5). Some of the factors blamed for this development are: (i) lower investment in coal mining, (ii) complex geological structures difficult to be mastered

applying obsolete technology, (iii) problems in the provision of spare parts and new mining equipment by the former Soviet Union and (iv) the slowdown in economic growth in the 1980s, followed by the current deep recession.

Although proven high-quality hydrocarbon reserves are estimated at only 13 million barrels of low-sulphur oil and 5 billion m^3 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 among the best in Eastern Europe. Large-scale onshore surveys were begun as early as 1947 and offshore geophysical studies have been carried out since 1960. The probability that up-to-date technology, particularly computer-based seismic interpretation, could reveal the existence of commercially interesting oil and gas resources is very high, 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, have been explored only slightly. Another 500 to 1,500 million barrels of oil in reservoirs of 100 to 300 million barrels each may exist [ibid.]. Production of oil and gas has been falling for a decade as a consequence of the lack of new reservoir discoveries (despite considerable government investment in exploration), the deterioration of infrastructure and operational equipment and the adverse development of the Bulgarian economy in the 1980s (Table A6).

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 9,570 tonnes of metal content, i.e. 330 tonnes of metal per year, on average. Production fell to 270 tonnes in 1990 and was finally stopped 1991, because 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, a].

2. Domestic Production of Electricity and Oil Derivates

There are three sources of electricity in Bulgaria: (i) domestic plants owned and operated by the Committee of Energy (1990: about 84 per cent of total supply), (ii) domestic plants linked to industrial conglomerates (8 per cent) and (iii) net imports from the former Soviet Union (8 per cent). Total generating capacity owned by the Committee of Energy was 10,896 MW in 1990, consisting of 5,161 MW from fossil fuel (coal, heavy fuel oil, gas) fired plants, 3,760 MW from the Kozloduy nuclear plant and 1,975 MW from hydropower plants (Table A7). Together with the capacity of industrial companies (1,100 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 12,000 MW. With the peak level of demand having reached 8,332 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 Committee of Energy 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 (pressurized 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 had raised serious objections concerning their operational safety. The programme, which is being coordinated, administered and financed by the Commission of the EC, does not yet allow predic-

tions about 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, which have utilization rates averaging only 50 per cent (optimal rates amount to more than 80 per cent), not only have 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, has 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 utilization 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 A8). Depending largely on the supply of water in the reservoirs and on differences in altitude occurring in the normal path of rivers, Bulgaria's hydropower potential is limited. Since 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 dam recently 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 had been activated at Kozloduy. While nuclear expansion continued throughout the 1980s, the contribution of hydropower to total output decreased because of 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 (45,036 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 A9), 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). Burgas represents about 85 per cent of total domestic refining capacity, which includes facilities for atmospheric (12 million t/year) and vacuum distillation (3.7 million t/year) and for other purposes, such as catalytic reforming, hydro treating, catalytic cracking, alkylation, viscosity breaking and MTBE production. Until 1991, it satisfied most of internal oil product demand. In addition, an increasing share of its capacity has been reserving for third-party processing. Crude throughput at Burgas declined from some 12 million tonnes in 1988 to around 6 to 8 million tonnes in 1991, because Soviet deliveries were reduced and the country was unable to diversify imports in the presence of the foreign debt problem and the foreign exchange constraint. Whereas 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 has specialized in lubricants (Pleven), and the other one (Ruse) has been closed down.

Whereas total Bulgarian refinery output began to decrease in 1990, the most important oil products rather showed production fluctuations already in the second half of the 1980s (Table A10). 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 petrol), 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. The first 110 kV electricity line (with a length of 1985 km) was established in 1959. By 1970, a 220 kV line had also been established, and the domestic electricity grid was carrying power to most parts of the country. In the 1970s and 1980s, a 400 kV line was added 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, a 750 kV line was constructed in order to establish a link with the former Soviet Union, particularly with the Ukraine. As can be seen from Table 8, Bulgaria's national electricity network is quite developed.

Bulgaria's electricity grid is connected with all neighbouring countries. Through the MIR (or IPS[9]) system, Bulgaria is synchronized with the former CMEA countries, notably with the Ukraine and Romania. With ex-Yugoslavia and Greece, both a part of the Western European UCPE[10] network, Bulgaria is linked on the basis of the so-called isolated island principle (i.e. partial synchronization) because of the different standards prevailing in the Eastern and Western grids. Moreover, 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.

Table 8 — The Length of Bulgaria's Electricity Lines by Voltage Levels, 1970–1990 (1000 km)

	1970	1975	1980	1985	1990
Low-voltage lines	48.7	54.2	60.0	63.2	67.8
Middle-voltage lines	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	—	—	—	—	0.09

Source: Committee of Energy, unpublished statistics and documents.

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 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 call for a synchronization of Bulgaria's grid with the one of Western Europe.

Bulgarian natural gas imports from the former Soviet Union enter the country through a pipeline coming from Romania; it has a nominal capacity of 9 billion m^3/year and supplies

mainly 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 its demand for primary and final energy. According to the energy balance for 1991, total energy imports, expressed in oil equivalent units, amounted to more than one and a half times the level of domestic production of primary energy (Table A14). Some 37 per cent of the total domestic input of coal was of foreign origin as well as almost all crude oil, natural gas and oil products. Net imports of electricity reached 7 per cent of total domestic electricity supply. Coal imports mainly consisted of hard coal and coke. Refined oil product imports referred particularly to fuel oil.

In 1991, Bulgaria's 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 of crude oil came from the former Soviet Union, with LDCs (especially Algeria, Lybia and Iran) providing the rest; imports from Irak, formerly a relatively important supplier, were interrupted because of the UN embargo against Irak in the wake of the last Gulf War. The former Soviet Union 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, 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 A5 to A6, A9 to A10 and A14, imports (expressed in physical units) decreased substantially in the period 1985–1991. Hard coal, coke, crude oil, refined oil products and electricity imports fell by 50, 81, 68, 20 and 50 per cent, respectively. First, the foreign supply of natural gas increased, reached its maximum in 1990 and then fell by 17 per cent in 1991. Imports of refined oil products, as motor and aviation petrol 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 Soviet Union was the collapse of the traditional CMEA clearing system, with trade valued in transfer rubles (an accounting currency unit) and the former Soviet Union switching to world market prices and hard currency in January 1991, as far as energy exports were concerned. In the old system, the Soviet Union charged a five-year moving average of world prices expressed in transfer rubles, using an extremely overvalued exchange rate vis-à-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 subsidized quantities of primary and final energy. This was the case for crude oil until May 1983 and during the last Gulf War; from May 1983 to July 1990 the opposite was true [Foders, 1991]. Energy imports were generally paid for with goods, as agreed in the 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 developed favourably for the energy-importing member coun-

tries of the CMEA. Some countries, notably Bulgaria, 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.

Thus, the distortions characterizing the CMEA region paradoxically resulted in both integration effects (trade diversion and trade creation in the energy field) and terms-of-trade effects. These potential benefits, however, seem to have been more than compensated by the risks implied by the development of an uncompetitive industrial structure and the high dependence on subsidized 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 Soviet Union to Central and Eastern Europe, resulting from serious disruptions of energy production and transport and trade in the former Soviet Union [Foders, 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. 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 (following Czechoslovakia, Poland and Hungary [Table 9]). In 1990, Czechoslovakia was the only Central and Eastern European country to use more energy than Bulgaria. 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 characterized by an inefficient use of energy; as Romania's too, Bulgaria's economy requires a comparatively high input of total energy per unit of GDP (Table 9).

Table 9 — Energy Consumption in Eastern Europe and Lower-Middle-Income Countries, 1965–1990

	Per capita consumption of energy				Energy efficiency[a]
	kg of oil equivalent			per cent[b]	
	1965	1970	1990	1965–90	1990
Bulgaria	1788	2657	4945	4	2.2
Czechoslovakia	3374	3893	5091	2	1.6
Hungary	1825	2053	3211	2	1.2
Poland	2027	2512	3416	2	2.0
Romania	1536	2136	3623	3	2.2
Eastern Europe[c]	2110	2650	4055	3	1.8
Algeria	226	219	1956	8	1.0
Malaysia	313	452	974	4	0.4
Argentina	975	1208	1801	2	0.8
Lower-middle-income countries[c]	826	1134	2419	4	1.1

[a]Energy consumption per unit of GDP at current exchange rates. — [b]Annual average growth rates. — [c]Unweighted average; the figure for the lower-middle-income countries includes Bulgaria.

Source: World Bank [b, 1992, 1993]; own calculations.

In contrast to the diversified structure of the total input of primary and final energy into the Bulgarian economy, in 1991 final energy consumption was concentrated on oil products and coal. Natural gas and coal accounted for about 12 per cent each, heat for 31 per cent, electricity for 20 per cent and oil products for 25 per cent. Taking into account that electricity and heat are both largely generated by coal and oil burning power plants, the contribution of coal and oil to final energy consumption is a major one.

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.

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 are 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 A5–A6 and A9–A10), some conclusions may be drawn regarding the evolution of this rough measure of consumption in the period 1985–1992. In spite of the continuing 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 the Bulgarian energy consumption.

6. Environmental Aspects

Bulgaria's industrialization strategy resulted in a heavy burden for the environment. Air, water and land resources were sytematically underpriced, and the exposure of these resources to pollutants stemming mainly from heavy industry and the energy sector resulted in high social costs 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.

Table 10 — SO_2 Emissions in Bulgaria, 1980, 1987 and 1990

	Sulphur content of fuel (per cent)	SO_2 emissions (million tonnes)		
		1980	1987	1990
Thermal power plants				
Lignite	2.5	0.9	1.2	0.8
Sub-bituminous coal[a]	1.7	0.1	0.1	0.1
Sub-bituminous coal[a]	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
Household heating				
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
Transport				
Diesel	0.3	0.01	0.01	0.01
Total		1.7	2.2	1.6

[a]Sub-bituminous coal is available in low- and high-sulphur quality.

Source: Committee of Energy, unpublished statistics and documents; own estimates.

To what extent can the environmental conditions in Bulgaria be attributed to the energy sector? Table 10 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-sulphur brown coal briquettes in households, generally for heating, makes them the second source of SO_2 pollution, especially in residential zones. The intensive utilization of coal is also associated with emissions of carbon dioxide (CO_2), which are excessively high in Central and Eastern European countries because of the dominant role of coal in their energy mix (Table 11). As far as Bulgaria is concerned, there are two main sources of CO_2 pollution, coal and oil, which is why Bulgaria comes very close to the average fuel shares in world CO_2

emissions. Eastern Europe accounted for about 6 per cent of global CO_2 emissions in 1990 and is expected to slightly reduce its share to around 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 12).

Table 11 — CO_2 Emissions by Type of Fuel in Selected Regions, 1985

	Coal	Crude oil	Natural gas
CO_2 primary emission factor	1.09	0.84	0.64
Fuel share (per cent)			
CEECs[a]	66.9	20.1	13.0
Former USSR	38.1	33.4	28.6
EC	32.9	51.8	15.3
USA	34.7	46.7	18.6
World	42.0	42.2	15.8

[a]Central and Eastern European countries.

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

Table 12 — CO_2 Emissions in Selected Regions, 1990–2050 (million tonnes of carbon)[a]

	CEECs[b]	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

[a]Simulation results with the OECD's GREEN model; business-as-usual scenario. — [b]Central and Eastern European countries.

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

Besides the energy mix, the level of energy consumption is another major reason for the important contribution of the energy sector to environmental pollution. Estimates for the income elasticity of energy demand in Eastern Europe are somewhat higher than those for the EC member countries and the United States (Table 13). They are on a par with the average elasticity for the world; energy demand in rapidly growing developing countries (Brazil, China, India and other 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 to a great extend energy price distortions (mainly subsidies) and their effect on the choice of production technologies at the firm level. Interestingly, in the case of Eastern Europe the CO_2 elasticity matches the energy elasticity, whereas in the EC and the United States the CO_2 elasticity turns out to be lower, and in the former Soviet Union (as well as in LDCs) it turns out to be higher than the energy elasticity (Table 13). This seems to underline the close relationship between CO_2 emissions and energy use in Central and Eastern Europe.

Table 13 — CO_2 Emissions and GDP Growth in Selected Regions, 1990–2000[a]

	Real GDP[b]	CO_2 emissions[b]	CO_2 elasticity[c]	Income elasticity of demand for energy[d]
	per cent			
CEECs[e]	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

[a]Simulation results. — [b]Annual average growth rates; business-as-usual scenario. — [c]Annual average growth rate of real GDP divided by the annual average growth rate of CO_2 emissions. — [d]Extended Linear Expenditure System (ELES) estimates. — [e]Central and Eastern European countries.

Source: Burniaux et al. [1992a, Tables 3, 5; 1992b, Table 15]; own calculations.

One of the major SO_2 pollutants in Bulgaria is the large Maritza-East power complex (about 700,000 tonnes of SO_2 per year). Although this complex is endowed with high stacks for dispersion and electrostatic precipitators to reduce the 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 environmental conditions are rather a result of the poor enforcement of such standards.

7. Strengths and Weaknesses

The *supply side* of the Bulgarian energy market is characterized by the following strengths:

- 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.

Its weaknesses are as follows:

- Bulgaria is only poorly endowed with primary energy resources and thus highly dependent on imports of primary energy.
- Energy imports come mainly from Russia, which is itself experiencing major supply disruptions.
- The available effective capacity to generate electricity falls short of peak demand, because power plant and distribution equipment is seriously deterioted.
- The only Bulgarian nuclear plant does not comply with Western safety standards.
- Primary energy production and transport have a strong effect on the environment.

The *demand side* of the Bulgarian energy market is characterized 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.

Its weaknesses are 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 has traditionally played a key role in Bulgarian economic policy. This is clearly reflected in the fact that Bulgaria opted for the former CMEA's energy-intensive industrialization strategy, in spite of being poorly endowed with energy resources. The widespread distortion 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 widening gap between energy demand arising from energy-intensive industrialization on the one hand and energy supply on the other hand. Energy supply consisted mainly of fuels imported from the former Soviet Union; 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.

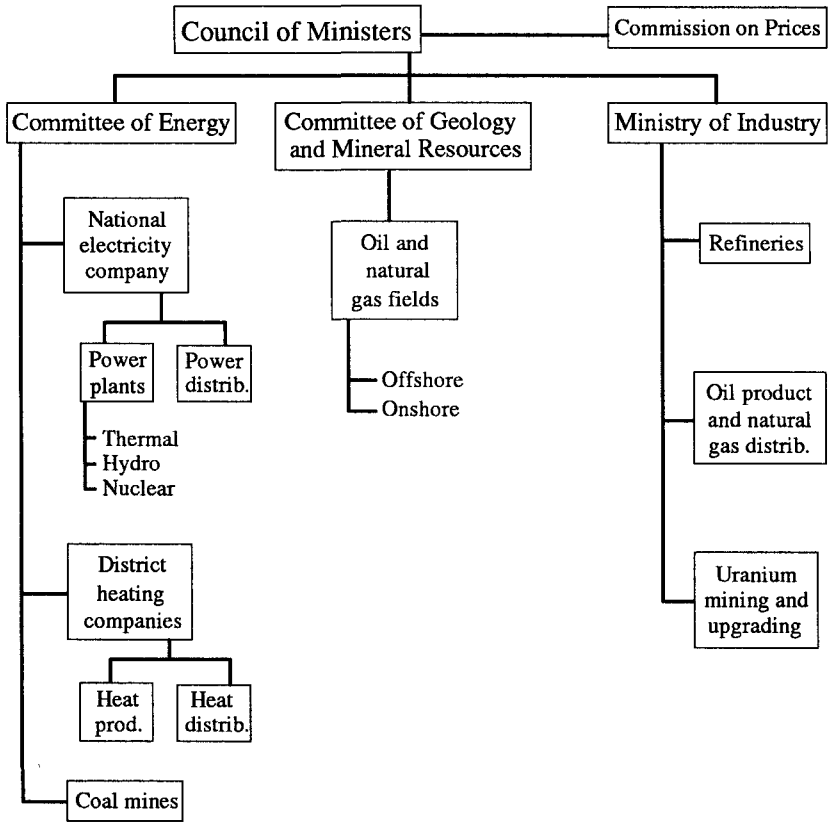
1. Organization of the Energy Sector

Although Bulgaria spent most of the postwar years practicing central planning, surprisingly energy policy and its institutions were decentralized. The energy sector consisted and still consists 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 this 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 responsible for energy pricing. In practice, the Council of Ministers sets prices at all levels and 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.

The inherited organizational structure of the energy sector is very likely to change in the event of total or partial privatization of energy companies. For the time being, however, energy companies will not be prepared for privatization. The only measure taken to strengthen these companies in the phase of economic transition was to create the legal background for transforming them into joint stock or limited liability companies. Also, plans for fostering 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

Figure 1 — Organization of the Energy Sector in Bulgaria, 1992



government is currently preparing the second 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 of investing 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 maximize the use of domestic energy resources, (ii) to rapidly expand the use of nuclear energy and (iii) to stimulate energy saving. The first priority was to encourage the utilization of low-quality lignite in thermal plants and households. Whereas the substitution of domestic coal for energy imports made sense as a short-run reaction to a transitory foreign exchange constraint, the second priority actually deepened Bulgaria's dependency on imports. This resulted from the fact that Bulgaria had to import almost every input into nuclear plants and, in addition, facilities to handle nuclear waste lacked; 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 protection 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. Another important non-official priority concerned energy prices. The government was committed to maintain relatively low prices for all users. The national policy of subsidizing energy consumption implied setting prices that were much lower than the domestic costs of production, importation and distribution of energy. The financial gap resulting from such a policy forced the electricity companies to operate permanently with deficits. At first, these deficits were entirely financed resorting to funds from the federal budget; later, they were increasingly financed with bank loans, which resulted in an important accumulation of internal debt by the sector (1991/92: 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 A11). Whereas 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 is still 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 inflation rate, 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 year 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 Bulgarian energy sector with its institutional and policy features has the following strengths:

- The sector is highly decentralized.
- 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.

Its weaknesses are as follows:

- Responsibility for energy policy is widely scattered and not clearly defined.
- There is no coherent energy policy.
- Energy consumption is still subsidized; prices are regulated.
- The structure of consumer prices favours households and discriminates against industry and other major consumers.
- The subsidization 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 and (iv) adverse environmental effect.
- There is no comprehensive legal-institutional framework for the production, distribution and consumption of energy.
- There is no privatization 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 type. As far as the ongoing process of transformation influences some of the conditions that 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 on 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, contributes to the discussion of policy options for Bulgaria. Drawing upon the economic analysis of the Bulgarian energy market and the public policy in Sections II to IV, I 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 (*Scenario A*) 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. This scenario involves a long period of recession-cum-inflation, with the corresponding high social costs in terms of unemployment, real income losses and capital flight. Under these circumstances, the transformation process could slow down, thereby adversely affecting the recent privatization initiative as well as the overall level of involving (local and foreign) private firms in the economy. Economic stability will not be achieved, and Bulgarian economic policies will quickly loose credibility both in the country and abroad. Foreign debt will remain a problem. With neither a liberalization of energy prices nor foreign direct investment in the energy sector in sight, the crisis in the Bulgarian energy sector is likely to deepen, even if energy demand were to fall significantly 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 will reduce the already narrow scope for imports. To maintain oil imports at past levels will 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 planned 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 desulphurization and similar facilities are neglected.

The role of energy policy in the base case does not differ much from the role 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 economic policy tolerates fundamental macroeconomic disequilibria. In such a scenario, energy policy could turn out to be irrelevant.

The second scenario (*Scenario B*) assumes that stabilization succeeds and the recession is overcome. According to the forecasts for the Bulgarian economy presented in Table 7, a low- and a high-growth scenario seem plausible. In the low-growth scenario, the economy of Bulgaria grows at a lower rate than in the high-growth scenario. The salient features of both growth paths, which differ in the length of the time period needed to recover from recession and to 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 privatized 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 becomes relevant. Price liberalization would be the measure most urgently needed; the domestic structure of energy prices should reflect international prices (all other inputs being valued at costs 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 has disappeared, Bulgaria's economy will be forced to lower the energy intensity of production 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 the Bulgarian energy policy in a growth scenario? Options should 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 maximize 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 Bul-

garia (Option E4). While in Options E1 to E3 taxes and price liberalization should be used as policy instruments to achieve the respective aims, Option E4 relies entirely on price liberalization (see Table 14 for an overview).

Table 14 — Energy Policy Options and Transition

	Scenario A[a]	Scenario B[b]	
GDP growth	Recession	Low	High
Fuel options	Irrelevant	E1: Natural gas E2: Oil E3: Nuclear energy	E4: Unknown a priori
Policy instruments	Irrelevant	Taxes and price liberalization	Price liberalization

[a]Business-as-usual scenario (slow transition). —[b]Accelerated transition.

The use of natural gas (Option E1) would fulfil the price criterion, in view of the fact that world reserves of natural gas by far exceed oil reserves. Moreover, about 40 per cent of total gas reserves are located in the former Soviet Union, mainly in the Russian Federation, which means that transport costs do not have a major effect on the supply costs of gas for Bulgaria. This option 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 (e.g. heating and cooking).

An increase in the share of oil in Bulgaria's fuel mix (Option E2) would have several 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 found out, the environmental effect of using oil intensively is considerably higher than the environmental effect of using natural gas intensively, particularly as far as CO_2 is concerned, even if it is still somewhat lower than the effect 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 costs of oil (from Russia or some OPEC member country) to Bulgaria would be negligible.

A full reliance on nuclear energy (Option 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 dumping of nuclear waste cannot as yet be done in the country; the corresponding services will also have to be imported. Moreover, it is questionable whether the existing plant at Kozloduy will remain in operation for any longer period of time. Technically, it will be difficult (and expensive) to achieve Western safety standards in the old Soviet-type reactors. Therefore, as elementary analysis shows, nuclear power does not appear to constitute either a profitable choice or an opportunity for Bulgaria to increase its independence from foreign energy supplies.

Finally, the conservation option (E4) implies that the liberalization 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 maximize 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 selects, two additional aspects should be given a leading role in the process of designing an appropriate energy strategy: (i) the environmental effect 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 CO_2. The alternative policy instruments proposed to reduce global CO_2 emissions include the introduction of a CO_2 tax in the OECD member countries, the introduction of an energy-cum-CO_2 tax only in the EC member countries and the implementation of a Toronto-type agreement with the participation of several countries (including developing, Eastern European and NIS countries).

As can be inferred from Table A12, global CO_2 emissions can be best reduced through a collective move of the kind implied by the Toronto agreement. The reason for this is that, because of 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 NIS. Thus, the global effect of unilateral OECD or EC moves is likely to be only marginal. Since the energy sector is a major contributor of CO_2 emissions, this underlines the global importance of designing energy strategies in Eastern Europe that explicitly take into account environmental aspects. At the same time, national policies (liberalization of prices) could significantly reinforce the total effect of concerted action on an international level (Table A12). According to simulations carried out with the OECD's GREEN model, the costs of reducing CO_2 emissions (in terms of real income losses) will be negligible, also for Eastern European countries (Table A13).

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 an environmental tax to be effective, however, it should be designed keeping the "polluter pays principle" in mind on the one hand, and, on the other hand, lists of inputs (fuels) or outputs (goods and services) embodying or otherwise related to the respective pollutant should be focused upon (CO_2, 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" (Eastern and Western Europe, including the former Soviet Union) and the G–24, has three main objectives: the expansion of trade in energy, cooperation 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 effect 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 Western 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 in modernizing other power stations and the transmission of power and heat within the country.

VI. Summary and Policy Conclusions

1. Summary of Findings

Bulgaria is scarcely endowed with energy resources (mainly low-quality lignite) and traditionally resorts to international trade to satisfy a major share of its demand for primary energy. As a member country of the former CMEA, Bulgaria pursued an energy-intensive strategy of industrialization in the period 1946–1989; during this period, it became highly dependent on fuel imports from mainly one source, the former Soviet Union. The rapidly increasing domestic energy demand led to a mounting gap between energy supply and demand. Regional developments after 1989 contributed to a further deepening of the Bulgarian energy crisis: the collapse of the CMEA and the rearrangement of the international economic relations of the former Soviet Union disrupted Bulgarian imports, thereby creating serious shortages of fuels.

Although Bulgaria makes use of a rather diversified basket of primary energy, operational problems affecting the domestic conversion of primary into final energy impose an important restriction on the level of energy supply. This bottleneck derives from the actual degree of capacity utilization in the electric power generation sector. Nominal installed capacity exceeds domestic electricity demand by far. However, power plants are generally unable to maintain high utilization rates and to meet peak demand because of both the use of deficient and obsolete equipment and the fuel supply shocks mentioned above.

In contrast to primary energy supply, the structure of final energy demand is heavily biased towards only two fuels, oil products and coal, particularly lignite. Major consumers of final energy are the chemical industry, the iron and steel industry, and households. The extremely low level of energy efficiency, the completely outdated equipment and the particular mix of domestic energy production and consumption observed in Bulgaria all have an adverse impact on the environment as measured by SO_2 and CO_2 emissions.

The current energy crisis in Bulgaria is the consequence of an energy policy that, over a period of several decades, favoured cheap energy and totally neglected investment in safety and environmental protection. Distorted energy prices encouraged energy use and led to the emergence of an economy governed by energy-intensive technologies. The transformation of the Bulgarian economy, initiated in 1989 and progressing only very slowly, has not yet brought about structural change in the energy sector. Not even the recession-cum-inflation experienced in 1991 and 1992 gave the country some relief from the energy crisis. Many of the distortions prevailing under central planning are still in place and new ones have appeared. Since prices for imported primary energy are on a par with international prices, since domestic prices of other inputs were liberalized in 1991 and since consumer prices for energy products are still lower than production costs, power plants and refineries have been accumulating substantial internal debt and thus have increasingly turned into a burden for the already deficit-ridden government budget. Furthermore, the existing pattern of consumer prices for energy continues to benefit households and to discriminate against industry, in spite of the fact that the marginal costs of providing energy in-

curred by the utilities is lower for industry than for households.

For systemic reasons, one would expect to find a highly centralized organization of the energy sector in Bulgaria. The opposite is true: Bulgarian public institutions and companies involved in the sector are rather decentralized. There is neither an energy ministry nor a division or department in any other ministry with the power to design, implement and monitor a national energy policy. Responsibility is widely scattered among several committees and other institutions, each of which enjoys a vague delimitation of their respective duties. Not surprisingly, a coherent energy policy is not yet in sight. Neither are detailed plans for a privatization of Bulgarian energy companies nor the participation of foreign companies in this sector. The same applies to a legal-institutional framework including laws governing production, transport and consumption of energy in a market economy.

2. Policy Conclusions

The following conclusions can be drawn from the economic analysis of the Bulgarian energy sector: *First*, energy reform cannot be separated from the overall transformation process. Energy reform is, in fact, a central part of it. To be effective, market-oriented energy policies presuppose the existence of an economic setting free of major micro- and macroeconomic disequilibria. As long as the most companies in the energy sector are government-owned, however, reliance on government involvement to achieve energy policy goals will remain crucial. *Second*, energy reform in an import-dependent transitional country will not be successful as long as trade barriers continue to affect energy demand and supply. In the case of such trade barriers, the wedge between international and Bulgarian prices for domestically produced primary energy (for example, lignite) remains unchallenged. *Third*, energy reform will not be feasible as long as a coherent energy policy and specific guidelines for the timing and sequencing of policy measures are absent. Furthermore, without restructuring the responsibility for energy and concentrating it in one ministry or agency to minimize present inefficiencies, the design of a coherent policy is virtually impossible. *Fourth*, there is a close link between energy production, transport and consumption on the one hand and environmental pollution on the other hand. This linkage should be taken into account in the design of a coherent policy. *Fifth*, the lack of a comprehensive legal-institutional framework for the energy sector is an obstacle to the efficient implementation and monitoring of a coherent energy policy. *Sixth*, without both the privatization of Bulgarian energy companies and a strong participation of foreign firms in the Bulgarian energy sector, Bulgaria is not very likely to have access to the capital and technology required to modernize the sector.

Energy policy should comprise (i) price liberalization to increase energy efficiency, (ii) taxation to reduce energy-related environmental pollution, (iii) a regional diversification of imports of primary and final energy and (iv) measures to attract investment and new technologies to the sector.

(i) Energy policy should concentrate on the liberalization of domestic prices for primary and final energy. For an efficient allocation of primary fuels produced domestically, the latter's prices should be on a par with import prices at the Bulgarian border for comparable fuel quality. The favourable geographical location of Bulgaria with respect to energy exporting countries reduces the importance of transport costs. Prices for final energy should reflect production costs and, at the same time, a rate of return on the capital invested in the production of energy products (e.g. not lower than the average rate achieved in the manufacturing industry). Once prices for primary and final energy indicate the true scarcity of these inputs and products, a fuel mix will emerge on both sides of the market that will contribute to an efficient use of energy and other resources.

(ii) The divergence of social and private costs associated with the environmental effect

of energy production, transport and consumption can be dealt with by taxing consumption. It should be noted, however, that such a tax (e.g. a uniform ad valorem percentage of the gross retail price of energy products including sales or value added tax) works indirectly and does not directly affect the polluter; thus, it does not offer incentives for the polluter to introduce abatement devices as, for example, desulphurization equipment. Emission fees, in contrast, do create such incentives but are not recommended here, because they are of a complex nature and assume a level of sophistication of the enforcing authorities that is generally not being met in Bulgaria. Moreover, the enforcement costs of emission charges are likely to be higher than the enforcement costs of a simple uniform tax at the retail level. Nevertheless, 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. If standards are not met, polluters should be fined.

(iii) Concerning the integration of Bulgaria into the world energy market, the trade component of energy policy should follow a principle of prudent financial management: "Never put all your eggs in one basket". A diversification of risk can be readily achieved by using a balanced array of fuels (including nuclear power) each of which are imported from several sources. Diversification of fuels and suppliers is the best hedge against potential supply disruptions.

(iv) 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). Whereas 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 is to take place within the framework of the European Energy Charter, will cover, among other things, the formulation and planning of energy policy, the development of (new) energy resources, the promotion of energy saving and energy efficiency, the modernization 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. As a result of opening this market, Bulgaria could, for example, increase its electricity imports and substitute them for electricity produced by 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.

As far as the timing and sequencing of policy instruments are concerned, Bulgaria should already *in the short run* begin to design, implement and monitor a new energy policy (as the one outlined above) and to concentrate the political responsibility for public policies affecting the energy sector. *In the medium run*, Bulgaria's energy market will benefit from an acceleration of the transformation process and the introduction of a comprehensive legal-institutional framework for the efficient operation of privatized Bulgarian companies and the participation of foreign companies in the modernization of the Bulgarian energy sector.

Appendix

Table A1 — Bulgaria's Industry Structure, 1991 (per cent)

	Output share		Output share
Mining	2.16	Basic industries (continued)	
Coal	2.1	Timber and wood processing	2.6
Oil and gas	0.06	Pulp and paper	2.0
Energy		Other industries	34.54
Electricity and thermal power	8.2	Glas and porcelain	1.1
Basic industries	55.1	Textiles	4.2
Ferrous metallurgy	7.9	Weaving apparel	1.3
Non-ferrous metallurgy	3.6	Leather, furs, footware	1.1
Machine building and metals	10.1	Printing and publishing	0.9
Electrical engineering	8.1	Food, beverages, tobacco	24.1
Chemical and petrochemical	18.3	Others	1.84
Construction materials	2.5		

Source: World Bank [c].

Table A2 — Direction of Bulgaria's Foreign Trade by Region/Country, 1990–1992 (per cent)

	Exports			Imports		
	1990	1991	1992	1990	1991	1992
OECD	11.87	26.28	42.3	21.62	32.82	46.5
EC	7.87	15.66	30.8	16.29	20.66	32.6
Germany	4.23	4.76	10.0	10.39	6.97	12.8
Greece	0.80	2.18	4.3	0.32	0.89	5.9
Italy	0.78	2.70	5.3	1.91	4.17	5.3
United Kingdom	0.56	1.94	3.0	1.65	3.61	1.9
Others	1.50	4.08	8.2	2.02	5.02	6.7
EFTA	1.54	3.37	3.3	3.23	7.81	6.7
USA	1.74	3.36	1.7	0.55	2.87	3.0
Others	0.72	3.89	6.3	1.55	1.48	4.2
Former CMEA[a]	76.27	54.96	41.8	68.35	49.06	37.1
Former USSR	64.01	49.77	25.2	56.49	43.23	28.6
Eastern Europe	12.26	5.19	16.6	11.86	5.83	8.5
Czechoslovakia	4.42	0.86	0.7	4.64	1.19	1.9
Poland	2.55	2.06	2.3	5.01	3.67	0.8
Romania	3.86	1.83	2.6	1.32	0.43	2.7
Others[b]	2.42	3.21	11.0	1.75	2.49	3.1
LDCs	11.86	18.76	4.6	10.03	18.12	2.5

[a]Only former USSR and Eastern Europe. — [b]Albania, Hungary and Yugoslavia.

Source: PlanEcon [c, August 1992, June 1993]; own calculations.

Table A3 — Commodity Structure of Bulgarian Foreign Trade by Regions, 1990 and 1991 (per cent)

	Exports		Imports	
	1990	1991	1990	1991
All regions				
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
Industrial consumer goods	10.3	22.3	6.4	4.4
Other items[a]	4.4	5.0	6.0	8.1
OECD				
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
Industrial consumer goods	12.1	20.0	8.7	7.4
Other items[a]	2.7	3.1	2.7	1.8
Former CMEA				
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	1.7	2.5	3.9	2.2
Processed foodstuffs	13.1	19.5	0.7	0.7
Industrial consumer goods	10.9	27.9	5.6	2.5
Other items[a]	2.6	0.8	1.5	6.8
LDCs				
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
Industrial consumer goods	3.5	6.2	9.4	4.7
Other items[a]	6.5	3.2	0.7	0.3

[a]Construction materials, agricultural non-food raw materials, live animals and material services.

Source: PlanEcon [c, August 1992]; own calculations.

Table A4 — External Debt Indicators, 1980 and 1991

	Total debt as a percentage of				Total debt service as a percentage of		Interest payments as a percentage of	
	exports		GNP		exports		exports	
	1980	1991	1980	1991	1980	1991	1980	1991
Bulgaria	2.9	237.9	1.1	151.7	0.3	22.1	0.2	6.1
Czechoslovakia	68.6	68.9	9.8	29.5	9.5	11.6	9.5	4.7
Hungary	95.9	180.8	44.8	77.0	18.9	32.5	10.8	13.2
Poland	54.9	281.4	16.3	68.5	17.9	5.4	5.2	3.3
Romania	80.3	39.3	na	6.9	12.6	3.0	4.9	1.5
Eastern Europe[a]	60.5	161.7	14.6	66.7	11.8	14.9	6.1	5.8
Algeria	130.0	214.8	47.1	70.4	27.1	73.7	10.4	15.8
Malaysia	44.6	53.7	28.0	47.6	6.3	8.3	4.0	3.6
Argentina	242.4	433.0	48.4	49.2	37.3	48.4	20.8	25.1
Lower-middle-income countries[a,b]	105.0	234.9	31.2	79.7	17.8	38.1	8.9	12.7

[a]Unweighted average. — [b]The average for the lower-middle-income countries includes Bulgaria.

Source: World Bank [b, 1992, Table 24, 1993, Table 24]; own calculations.

Table A5 — Bulgaria's Production, Trade and Apparent Consumption of Coal, 1985–1992

	Production	Imports	Exports	Apparent consumption
		Hard coal[a] *(million tonnes)*		
1985	223	8054	529	7748
1986	207	7304	306	7205
1987	198	7258	239	7217
1988	196	6451	23	6624
1989	193	6171	—	6364
1990	143	5790	—	5933
1991	120	3968	—	4088
1992[b]	100	2500	—	2600
		Brown coal (1000 tonnes)		
1985	30657	—	—	30657
1986	35015	—	—	35015
1987	36621	—	—	36621
1988	33951	—	—	33951
1989	34105	69	—	34174
1990	31526	107	—	31633
1991	28680	87	—	28767
1992[b]	28964	80	—	29044
		Coke (1000 tonnes)		
1985	1087	664	—	1751
1986	1156	471	—	1627
1987	1314	309	—	1623
1988	1457	196	—	1653
1989	1561	93	—	1654
1990	1250	96	—	1346
1991	1000	124	—	1124
1992[b]	900	120	—	1020

[a]Anthracite, bituminous and sub-bituminous coal. — [b]Estimate.

Source: Committee of Energy, unpublished statistics and documents; PlanEcon [b, 1992, 1993]; own estimates.

Table A6 — Bulgaria's Production, Trade and Apparent Consumption of Crude Oil and Natural Gas, 1985–1992

	Production	Imports	Exports	Apparent consumption
		Crude oil (1000 tonnes)		
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	—	4460
1992[a]	60	2700	—	2760
		Natural gas (million m^3)		
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	12	5658	4	5666
1992[a]	12	5250	3	5259

[a]Estimate.

Source: See Table A5.

Table A7 — Average Annual Installed Capacity of Power Plants in Bulgaria,[a] 1988–1990 (MW)

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

[a]Administered by the Committee of Energy. — [b]Revised data.

Source: Committee of Energy, unpublished statistics and documents.

Table A8 — Capacity of Major Hydro Plants in Bulgaria, 1990

	Installed capacity (MW)	Net heat (m)	Discharge (m^3/sec.)	No. of turbines	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
Mormina 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, unpublished statistics and documents.

Table A9 — Bulgaria's Production,[a] Trade and Apparent Consumption of Electricity, 1985–1992 (million kWh)

	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[b]	34304	2500	760	36044

[a]Primary and secondary electricity production. — [b]Estimate.

Source: Committee of Energy, unpublished statistics and documents; PlanEcon [b, 1992, 1993]; own estimates.

Table A10 — Bulgaria's Production, Trade and Apparent Consumption of Refined Oil Products, 1985–1992 (1000 tonnes)

	Production	Imports	Exports	Apparent consumption
		Total refined oil products		
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[a]	1950	1630	90	3490
		Motor and aviation petrol		
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	700	61	50	711
1992[a]	560	40	40	560
		Gas–diesel oil		
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	1300	336	100	1536
1992[a]	560	320	60	820
		Fuel oil		
1985	3730	1630	—	5360
1986	3546	1531	—	5077
1987	3570	1337	11	4896
1988	3698	1043	11	4730
1989	3823	994	9	4808
1990	2380	984	3	3361
1991	1000	853	—	1853
1992[a]	440	1000	—	1440

[a]Estimate.

Source: See Table A9.

Table A11 — Selected Electricity Prices in Bulgaria, 1980–1992 (leva/kWh)

Households	1980	1985	1990	1991[a]	1991[b]	1992[c]
Daytime	0.034	0.045	0.045	0.167	0.284	0.383
Nighttime	0.012	0.020	0.020	0.088	0.150	0.203
Industry and government	Winter tension			Summer tension		
1992[c]	high	medium	low	high	medium	low
Daytime						
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
Nighttime	0.340	0.351	0.368	0.293	0.303	0.318

[a]February. — [b]June. — [c]May.

Source: Committee of Energy, unpublished statistics and documents.

Table A12 — Reducing Global CO_2 Emissions in Alternative Policy Scenarios, 1990–2050[a]

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
	Business as usual	CO_2 Tax in OECD countries	Energy-cum-CO_2 tax in EC countries	Toronto agreement	Liberalization of energy prices
	CO_2 emissions in 2050 (mil. tonnes of carbon)	Cut in CO_2 emissions in 2050[c] (per cent)			
CEECs[b]	909	—	—	–42	–44
Former USSR	2394	—	—	–37	–17
EC	1273	–36	–38	–49	25
USA	2295	–42	—	–53	1
World	18998	–11	–3	–64	–20

[a]Simulation results. — [b]Central and Eastern European countries. — [c]Relative to Scenario 1.

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

Table A13 —Costs and Benefits of Global CO_2 Emission Reduction in Alternative Policy Scenarios, 1990–2050 (per cent)[a]

	Scenario 2	Scenario 3	Scenario 4	Scenario 5
	CO_2 tax in OECD countries[b]	Energy-cum-CO_2 tax in EC countries[b]	Toronto agreement[b]	Liberalization of energy prices[c]
CEECs[d]	0.2	0.1	0.5	1.1
Former USSR	—	—	–0.2	
EC	–0.3	–0.6	–0.8	0.1
USA	–0.3	—	–0.8	
World	–0.3	–0.1	–1.4	0.5

[a]Simulation results. — [b]Real GDP changes relative to the business-as-usual scenario. — [c]Changes in the present value of real household income over the period 1990–2050, relative to the business-as-usual scenario. — [d]Central and Eastern European countries.

Source: See Table A12.

Table A14 — Energy Balance for Bulgaria, 1991 (tonnes of oil equivalent)

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

Table A14 — continued

	Crude LPG and other petroleum gases	Light petroleum products	Heavy petroleum products	Other petroleum products	Natural gas	Other derived gases
Production of primary energy	—	—	—	—	8052	—
Imports	—	253917	1643519	—	4475773	—
Exports	—	-3679	-12394	—	—	—
Changes in stocks	2464	275243	64696	—	115038	—
Gross consumption of primary energy	2464	525481	1695821	—	4598864	—
Energy converted (total)	224601	1212293	465005	80080	-2544254	147873
Coal briquette plants	—	—	—	—	—	—
Coal coke plants	—	—	—	—	—	98038
Blast furnaces	—	—	—	—	—	137740
Petroleum refineries	250067	1347941	278841	80080	—	—
Public power plants	—	—	-42968	—	-317097	—
Power plants of selfproduction	-25466	18	-506048	—	-1023080	-87905
Plants for combined generation of electricity and heat	—	-2303	-257080	—	-950257	—
Heating plants	—	-133363	-1457739	—	-253819	—
Other energy conversion industries	—	—	—	—	—	—
Consumption by energy-producing industries	—	—	—	—	—	—
Losses in transport and distribution	-1154	-14	—	—	—	-13171
Non-energy use	-173750	-487059	-82837	-80080	-333293	-134702
Final consumption (total)	51711	1251063	2104753	—	1684225	—
Manufacturing, mining and construction (total)	20967	128398	423878	—	1620390	—
Steel industries	—	980	8540	—	149940	—
Non-ferrous metal industries	630	5460	89740	—	7140	—
Chemical industries	910	23590	10290	—	953120	—
Other manufacturing industries	19426	98368	314888	—	510190	—
Transport (total)	34	257921	706521	—	—	—
Rail transport	2	4089	75691	—	—	—
Road transport	31	54598	363140	—	—	—
Waterway transport	—	86	266325	—	—	—
Air transport	—	199149	1365	—	—	—
Households and other consumers (total)	30711	864744	974354	—	63834	—
Households	30698	509890	114826	—	—	—
Agriculture, forestry	—	130110	531938	—	17678	—
Trade	1	71695	31440	—	2753	—
Other consumers	12	153049	296151	—	43403	—
Statistical differences	450	-362	-26764	—	37092	—

Table A14 — continued

	Nuclear hydro- and geothermal energy	Electric energy	Steam and hot water	Total
Production of primary energy	4215886	—	—	9177973
Imports	—	319545	—	14051738
Exports	—	–141231	—	–163130
Changes in stocks	—	—	—	429888
Gross consumption of primary energy	4215886	178314	—	23496469
Energy converted (total)	–4215890	3346770	4387971	–7732517
Coal briquette plants	—	—	—	–39124
Coal coke plants	—	—	—	–82301
Blast furnaces	—	—	—	—
Petroleum refineries	—	—	—	–97153
Public power plants	–4189010	2739170	—	–5912889
Power plants of selfproduction	—	312340	1489250	–484663
Plants for combined generation of electricity and heat	—	295260	1147262	–862888
Heating plants	–26880	—	1751459	–252511
Other energy conversion industries	—	—	—	–988
Consumption by energy-producing industries	—	–361550	—	–361550
Losses in transport and distribution	—	–459160	–212922	–686421
Non-energy use	—	—	—	–1291722
Final consumption (total)	—	2704374	4175049	13522759
Manufact., mining and construction (total)	—	1457965	3204967	7490937
Steel industries	—	199220	102130	879200
Non-ferrous metal industries	—	132300	49560	327180
Chemical industries	—	388150	1291010	2817140
Other manufacturing industries	—	738295	1762267	3466947
Transport (total)	—	88817	15019	1076833
Rail transport	—	71354	6601	164466
Road transport	—	15325	7829	442371
Waterway transport	—	580	387	267723
Air transport	—	1558	202	202274
Households and other consumers (total)	—	1157591	955063	4954988
Households	—	894626	635738	3012579
Agriculture, forestry	—	74463	149780	938950
Trade	—	53929	29433	200199
Other consumers	—	134574	140113	803260
Statistical differences	–4	—	—	–98500

Source: Committee of Energy, unpublished statistics and documents.

Notes

1 The figure of 8.99 million reflects the position before the mass emigration (of ethnic Turks and other citizens) since the fall of communism.

2 Cotton products, carpets, overcoats, men's suits, women's dresses, leather shoes and medicines.

3 Issues discussed in London include (i) a partial write-off of debt, (ii) permission for Bulgaria to buy back its debt in the secondary market and (iii) a debt-equity swap programme [PlanEcon, a, 1992].

4 The official discount rate, which was at 4.5 per cent p. a. in 1990, was raised to 54 per cent in March 1991, but lowered to 41 per cent p. a. one year later [OECD, CCEET, 1993].

5 The OECD estimates a budget deficit of 12.7 and 14.8 per cent of the GDP for 1990 and 1991, respectively [OECD, CCEET, 1992, p. 16].

6 A firm complies with Bulgarian privatization rules if it has a complete ownership documentation and a relatively "good" financial situation (i.e. 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, a, 1993, p. 8].

7 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 Baumol [1986].

8 If no other source is explicitly given, data mentioned in this chapter has been provided by the Bulgarian Committee of Energy.

9 Interconnected Power Systems.

10 Union for the Coordination of Production and Transport of Electricity. This is the world's most important grid (384 GW).

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