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Source: *Ambio*, Vol. 17, No. 5 (1988), pp. 323-329

Published by: [Springer](#) on behalf of [Royal Swedish Academy of Sciences](#)

Stable URL: <http://www.jstor.org/stable/4313488>

Accessed: 07/08/2013 17:58

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Economic Growth and the Environment in Yugoslavia: An Overview

Article

By Stanley J. Kabala

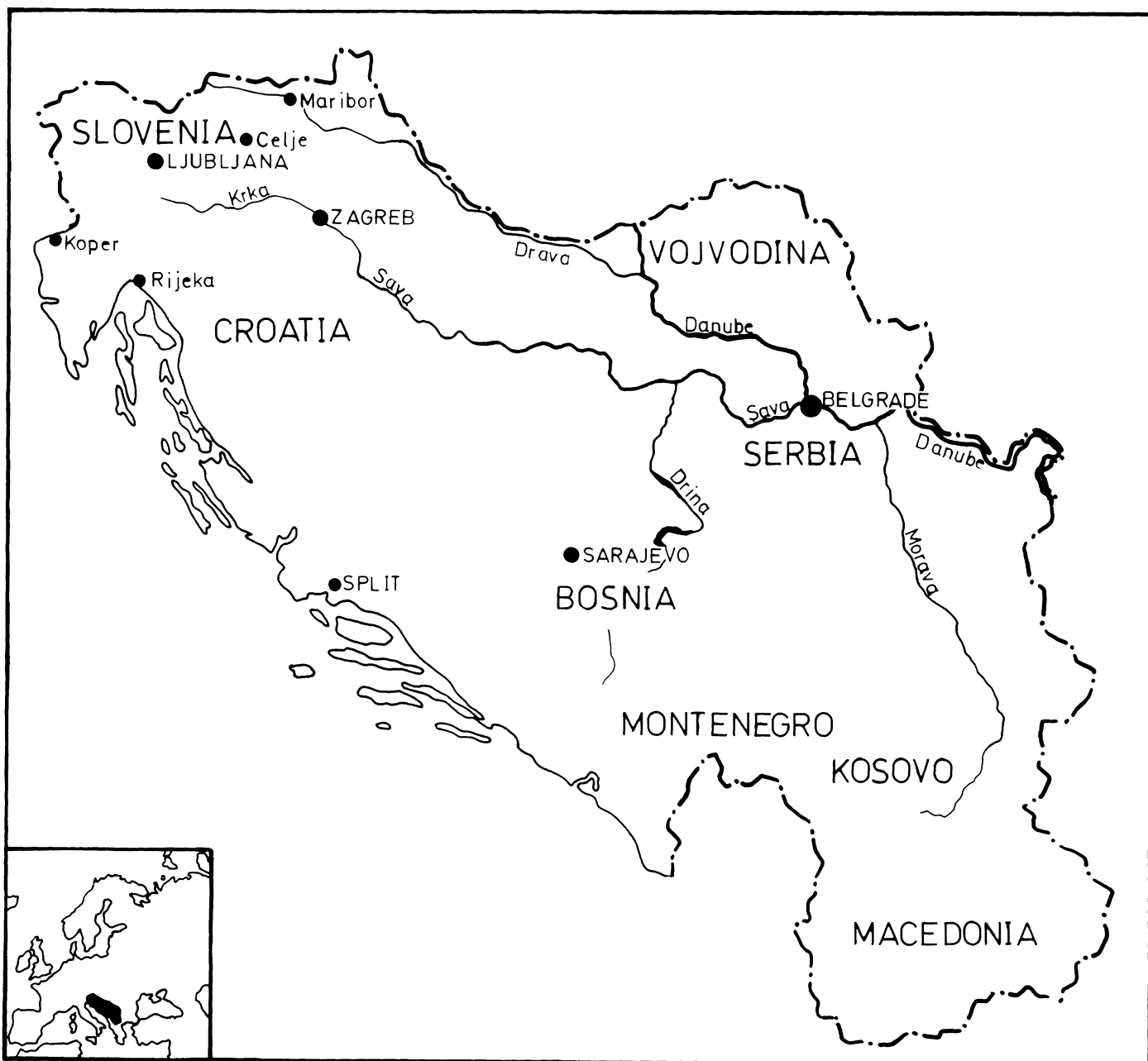
THE DEVELOPMENTAL CONTEXT

A country at the intermediate stage of economic development, Yugoslavia has not yet experienced the acute generalized effects of development-induced air and water pollution that more heavily industrialized countries in Europe are undergoing. However, economic growth, based on increased consumption of energy and materials, remains the country's goal, and if only a few of the planners' projections are realized Yugoslavia will have created for itself an environmental problem similar to that of its European neighbors. Counterposed to the environmental stresses that will result from economic growth is an increasing ecological awareness among the general public and the scientific community.

Like many countries at the intermediate stage of economic development, Yugoslavia has not yet experienced the acute generalized effects of development-induced intensive air and water pollution that more heavily industrialized countries in Europe are undergoing. At the same time, even this moderate level of development points to aggravated environmental deterioration in the years to come.

For nations pursuing industrialization increased use of inanimate energy is regu-

Map of Yugoslavia.



larly viewed as a correlate of development. While in the industrialized countries the assumption that economic growth must be accompanied by growth in energy consumption has now been rejected (1), this assumption remains largely true for developing countries. The historical pattern seen in industrialized nations indicates that for a country to reach an intermediate stage of industrialization, consumption, and resource use, sets the stage for further increases in these categories. Whether this pattern can be repeated for countries in the resource-short world of the future is questionable.

Economic growth based on greatly expanded consumption of energy and material resources remains the goal of Yugoslavia's planners in the 1980s (2). Even if only a portion of the planners' projections is realized, without very careful attention to ecological constraints Yugoslavia will have created for itself an environmental problem similar to that of its European neighbors.

Yugoslavia has a population of 22 800 000 in an area of 255 800 km² making for a population density of 88 persons per km². Twenty-five percent of the country has a population density of only 30 persons per km² and only eight percent of the area has a population density of more than 150 persons per km² (3). In comparison to other European countries Yugoslavia's annual per capita consumption of energy is low (Table 1). Neither the overall distribution of population nor the aggregate level of development constitute extreme environmental problems for Yugoslavia. However, the concentration of population and industrial development do pose environmental difficulties.

Following World War II Yugoslavia undertook the rebuilding and modernization of its economy as did many other East European nations. For Yugoslavia, unlike its communist counterparts in the region, this did not take the form of a massive drive toward industrialization. Among other things Yugoslavia's 1948 break with the Soviet Union freed it from the obligation to follow the classical "Stalinist" pattern of development formulated in the Soviet Union in the 1930s and copied by most of the communist countries of Eastern Europe in the 1950s (5). This Stalinistic pattern, with its extreme emphasis on heavy industry at the expense of social infrastructure and consumer goods, is in large part responsible for the ecological calamity that confronts the industrial nations of Eastern Europe (6). Yugoslavia's developmental intentions will lead it into the same predicament if pursued unchanged into the next century.

AIR

The greatest and most endemic constituent of air pollution is sulfur dioxide (SO₂). The gaseous by-product of the combustion of various fossil fuels SO₂ is ecologically most destructive in the form of acid rain, an atmospheric phenomenon that is wreaking havoc on buildings, forests, farmland, and watercourses across Europe, North America, and other industrialized parts of the

Table 1. Per capita energy consumption in selected European countries (4).

Country	Population (millions)	Total consumption million tons CE, 1982	Tons CE per capita
Czechoslovakia	15.2	116	7.6
France	54.4	239	4.4
FRG	61.6	386	6.3
GDR	16.7	124	7.4
Greece	9.7	20	2.1
Hungary	10.7	38	3.6
Italy	56.7	189	3.3
Poland	36.4	201	5.5
Romania	21.6	89	4.1
Sweden	8.3	52	6.7
UK	54.3	304	5.6
USSR	271.2	1492	5.5
Yugoslavia	22.8	47	2.1

CE = coal equivalent.

world. Of the 1.46 million metric tons of SO₂ deposited annually domestic emissions account for 830 000 tons, making Yugoslavia one of the several European countries that are "net importers" of this pollutant (4). Annual nationwide potential deposition per square kilometer is 5.7 tons, a figure considerably lower than levels in other European countries where air pollution and acid rain have become acute problems. By comparison, the Federal Republic of Germany has an annual deposition rate of 14.5 tons SO₂ · km⁻², the German Democratic Republic, 35.0 tons, Poland 12.8 tons, and Czechoslovakia 22.6 tons (7-9).

Deposition levels can be assumed to vary over Yugoslavia, as is the case for other countries and regions, making national aggregate figures less than helpful for purposes of analysis. Depositions in industrial and urban zones are usually much higher than aggregate national figures. For Yugoslavia deposition parallels, to some extent, ethnic and regional geography. Differences in economic level and degree of industrialization often correspond to regional boundaries. From extremely prosperous Slovenia in the north to underdeveloped Kosovo in the south Yugoslavia becomes progressively less industrialized, with levels of pollution and environmental concern closely related to levels of industrialization.

Assuming that levels of generalized pollution correspond to levels of energy consumption and overall industrial activity, approximate regional shares of pollution can be estimated (10). Table 2 shows the degree to which regional shares of national social product corresponds to regional shares of national industrial product and national electricity consumption. Regional shares of electricity production, a potentially polluting activity, diverge from this pattern in the cases of Croatia, Serbia, and the largely agricultural Vojvodina. Figures vary widely for regional shares of national SO₂ deposition and corresponding concentrations of SO₂ in regional territory; calculated according to regional share of national social product. Deposition in Slovenia is 10.3 tons SO₂ · km⁻², in Croatia 6.6 tons, in Serbia 6.3 tons, in Vojvodina 7.7 tons, in Bosnia-Herzegovina

3.8 tons, in Macedonia 3.3 tons, in Montenegro 2.1 tons, and in Kosovo 3.1 tons.

Thus, the small region of Slovenia receives a proportionately greater pollution burden than any other republic or province. The relatively underdeveloped regions of Kosovo and Montenegro receive only small amounts of the country's total air pollutant load. The levels involved are generally traceable to emissions from lignite-fired generating stations in these regions. Territorially small Slovenia is contiguous with much larger Croatia and the level of development in the two republics is comparable, thus, a combined figure for the two regions might present a more accurate picture of pollution levels. Taken together, Slovenia and Croatia constitute 30 percent of Yugoslavia's national social product and 42.5 percent of its national industrial product. Over the combined territory SO₂ deposition levels are 7.7 tons per square kilometer.

Two factors combine to lower Slovenia and Croatia's share of national pollution. First, a significant share of Slovenia's electricity capacity is based on hydropower, a virtually nonpolluting technology. Second, for some time these two republics have shunned the development of environmentally hazardous industrial activities that have been welcomed by the less-developed regions of the south (11). At the same time, Slovenia and Croatia are situated closest to those countries to the west and north from which Yugoslavia receives most of its imported air pollution (4). Therefore the high figures given above for Slovenia and Croatia would appear to be valid. This general condition is corroborated by air-pollution figures for principal urban areas which show that the two northern republics combined have geographically specific levels of SO₂ that are disproportionate to their share of the total population.

By the year 2002 total emissions of SO₂ in Yugoslavia are projected to increase from the 1982 level of 0.83 million tons to 1.91 million tons while total depositions will increase from 1.46 million tons to 2.14 million tons (5). Yugoslavia will be responsible for a much greater share of its SO₂ pollution. Domestic emissions in

Table 2. Regional share of national aggregate economic activity in selected categories (percentages) (44).

Region	Land area	Population	National social product	National industrial product	Electricity consumption	Electricity production
Slovenia	7.9	8.4	15.0	18.6	14.7	18.7
Croatia	22.1	20.4	25.6	22.9	20.2	11.4
Serbia	21.9	25.3	24.2	24.5	23.7	37.3
Vojvodina	8.4	9.0	11.4	9.6	10.1	2.0
Bosnia-Herzegovina	20.1	18.5	13.6	14.8	15.7	17.2
Macedonia	9.9	8.6	5.7	5.8	8.1	4.6
Montenegro	5.4	2.6	2.0	1.7	4.6	3.4
Kosovo	4.3	7.2	2.3	2.2	2.9	5.4

proportion to total depositions, will rise from 21 percent in 1982 to 33 percent in 2002. Annual nationwide deposition of SO₂ will rise from 5.7 to 8.4 tons · km⁻². With this increase, the deposition of SO₂ will have entered the low critical range for the pollutant.

While those predicted levels are serious; lower aggregate deposition rates can be sufficient to produce deleterious effects. The extreme damage being monitored in Poland today is the result of a national deposition rate that reached 8.8 tons · km⁻² in 1980. Yugoslavia can come close to this level by the year 2002. Damage to forests, farmland, and buildings will not occur immediately, but depositions maintained at such levels over several years can be expected to produce the same progressive devastation of natural, cultural, and economic assets in Yugoslavia that have already occurred elsewhere in Europe.

Were the regional spread of deposition to remain stable, Yugoslavia's more developed republics would face a mounting air pollution problem by the turn of the century. Slovenia would receive depositions at a rate of 14 tons · km⁻², while Croatia, Serbia, and Vojvodina would receive 9 to 11 tons · km⁻²—the beginnings of a crisis. Two factors work, however, to modify this simple projection. First, there is the environmental resistance to potential polluting investments in the northern republics that will probably maneuver such enterprises to the less resistant south. Second, Yugoslavia's growing energy economy (slated to double by the year 2000) will rely primarily on domestic low-caloric lignite for its supply. The main deposits of this relatively clean lignite (sulfur content 1.2 percent) are located in Kosovo and the Kolubara district of Serbia, both underdeveloped regions. Federal planning calls for the use of the lignite in thermal power stations in the vicinity of the deposits (2).

FORESTS

Forests are among the first victims of air pollution. In the more industrialized countries of central and northern Europe the extensive destruction of lakes and forests as a result of acid rain has generated public and governmental awareness on a remark-

able scale. In the Federal Republic of Germany (FRG), one of several countries of Central Europe where the natural environment is suffering an onslaught of air pollution, a new word, "Waldsterben" (forest death), has entered the vocabulary and the agendas of virtually all political parties (12, 13). The problem is so widespread and acute that it has broken the typical silence maintained by Europe's communist governments about their economic problems, with the German Democratic Republic (GDR), Czechoslovakia, Poland, and the USSR acknowledging the existence of similar problems within their borders (14–16).

Industrial pollution formerly affected heavily industrialized areas, such as Germany's Ruhr Basin or Poland's Upper Silesia; now, however, the entire Central European region is affected. As the root of the alarm over acid rain is the extent and the spread at which damage is caused. A 1981 study by the Ministry of Health in the FRG found that eight percent of the arable land had become unfit for farming and that some 34 percent of the nation's forests were dead or damaged as a result of acid precipitation. Tens of thousands of hectares of former forest on the border of the GDR and Czechoslovakia are now denuded, reforestation efforts have failed, and land will no longer produce crops (12, 13). In southwestern Poland 180 000 hectares of forest are reported to be dead or dying and some environmental scientists in Poland estimate that 3 000 000 hectares could be permanently damaged by 1990 (17). Forest damage is not as extensive in other European countries, but since the early 1980s reports of pine-forest damage have emerged from Italy, France, the Netherlands, and Switzerland—countries where SO₂ deposition rates are well below those typical of Central Europe.

With 9 225 000 hectares, or 36 percent of its land area, in woodland, Yugoslavia is richly endowed with forests. In terms of population, it has 0.42 hectares of forest per inhabitant, over one-third more than the European standard of 0.3 hectares per person deemed adequate to meet all needs for wood and wood products (3). Yugoslavia has registered none of the extensive forest damage that has alarmed scientists

in neighboring countries to the north. Forest land has actually increased in recent decades (from 8 688 000 hectares in 1961). Where damage to forests does occur it is caused by natural causes such as grazing, wind, erosion, and fire. This situation could change within the next two decades as SO₂ deposition increases. European experience suggests that sustained SO₂ deposition at the levels Yugoslavia is likely to reach in the 1990s is sufficient to cause forest damage.

Large areas of Yugoslavia's forests are situated in the porous terrain typical of much of the country's mountainous regions. The deterioration of forest conditions as a result of acute air pollution is likely to combine with the already tenuous hold of the forest on this terrain to accelerate deforestation.

WATER

A considerable part of Yugoslavia's air pollution is of foreign origin. Transboundary air pollution has now become a major topic for discussion and negotiation among European states. Likewise, Europe's rivers pose a similar problem as they both divide, and join, numerous countries. The water quality of the river Danube affects Yugoslavia and other central European states, as the river is used intensively by all the countries through which it flows.

The Danube accumulates pollutants as it passes through West Germany and Austria, but degradation increases dramatically close to the city of Vienna. The ineffective treatment of municipal sewage from the city of Vienna fails to remove certain bacteria and viruses, including polio and hepatitis, and these pose a serious threat to the quality of drinking water downstream in Lower Austria (18). From Austria the Danube flows southward and forms the border between Czechoslovakia and Hungary. These two countries bear the brunt of the pollution that originates upstream, but they also add to the total pollutant load. By the time the river reaches Budapest, it is so contaminated that swimming is not advisable (19). Upon entry into Yugoslavia the quality of the Danube water is markedly low. High concentrations of industrial pollutants such as

Table 3. Concentrations of urban air pollution by region (mg SO₂ · m⁻³) (3).

<i>Slovenia</i>		<i>Croatia</i>	
Ljubljana	0.190	Zagreb	0.166
Celje	0.183	Rijeka	0.155
Jesenice	0.087	Karlovac	0.087
Maribor	0.095		
Velenje	0.042	<i>Serbia</i>	
Novo Mesto	0.059	Beograd	0.045
		<i>Bosnia-Herzegovina</i>	
<i>Macedonia</i>		Sarajevo	0.154
Skopje	0.057		

Table 4. Water quality of principal rivers at point of entry into Yugoslavia, 1974–1980 (20).

River	Prescribed class	According to BOD ₅	According to phenols	According to coliform count
Danube	2	4	3–4	4
Drava	–	2	3–4	3
Mura	–	4	3–4	4
Tisa	2	4	3–4	4
Begej	2	4	3–4	4

heavy metals (cadmium, lead, zinc, and mercury) and phenols, as well as organic waste and bacteria have become a matter of concern.

In Yugoslavia water quality is classified in four categories: Class 1. Suitable for drinking; Class 2. Suitable for bathing and fish farming; Class 3. Suitable for irrigation and industrial uses; Class 4. Requiring special treatment prior to any use. Table 4 shows classification of Yugoslavia's principal international rivers at their points of entry into the country. Of Yugoslavia's total streamflow 22 percent is estimated to belong to Class 1; 38 percent to Class 2; 32 percent to Class 3; and 7 percent to Class 4 (3).

The Sava is Yugoslavia's largest river and the most seriously polluted. Its catchment area of 96 000 km² holds a population of some nine million people as well as the largest industrial concentration in the country. The intensive use of water from the Sava for urban industrial and agricultural needs has generated an increasingly large burden of pollutants. Along its length water quality hovers between Classes 3 and 4. The most polluted stretch from Zagreb to the mouth of the river is marked by large quantities of phenols and heavy metals.

In 1984 the newspaper *Politika* called the Sava a "river without life." Untreated discharge of sewage constitutes the major pollutant. By the mid-1980s only about half of the total discharge was treated by biological processes (20). The situation is comparable for industrial wastewater treatment, despite the fact that a substantial number of industrial-waste treatment plants have been built.

Diffuse sources of pollution constitute the remaining major pollutants in the Sava. The volume of these pollutants has grown with the modernization of agriculture in Yugoslavia. Increased use of artificial fertilizer and chemical pesticides is an integral part of modern agriculture. This intensive use of fertilizer results in runoff from farmland and ultimately the eutrophication of bodies of water.

Yugoslavia ranks moderately among European countries in terms of average aggregate fertilizer use (65 kg per cultivable hectare). Rates for other East Euro-

pean countries are Bulgaria 151 kg per cultivable hectare; Czechoslovakia 248; the GDR 270; Hungary 225; Poland 186; and Romania 91. In comparison, some figures for Western Europe are Austria 82 kg; Belgium 299; France 143; FRG 233; and Spain 45 (21). Except for locations where topography and streamflow concentrate natural runoff Yugoslavia does not seem to be in line for acute eutrophication of lakes or nitrate pollution of drinking-water supplies.

Despite intensive use by both Italy and Yugoslavia, the Adriatic Sea remains in good condition compared to other regional seas, such as the Baltic. Several semi-enclosed shore areas in Yugoslavia have been assessed as endangered as a result of heavy flows of industrial, urban, and river-borne agricultural effluents. However, the shallow Istra-Trieste-Venice Bay in the north is in a serious condition, with Rijeka Bay nearing endangered status (20). Other endangered areas are the Koper, Pivan, Bakar, and Kotor bays and Pula, Split, and Bar Harbors. Yugoslavia's contribution to the pollution of this arm of the Mediterranean is much less than would be expected in view of her large share of the coastline. This is mainly due to the fact that the great majority of Yugoslavia's rivers flow toward the Sava and the Danube and then eastward through Romania and Bulgaria to the Black Sea.

ENERGY CONSUMPTION AND SUPPLY

Energy consumption is highly correlated to economic development and is a major factor in pollution. In the two decades from 1958 to 1979 total energy consumption in Yugoslavia grew at an annual rate of 6.7 percent (compared to a world rate of 4.4 percent) more than quadrupling the 1957 consumption level of 11.8 million tons of coal equivalent to the 1979 level of 49.1 million tons. The result of this rapid growth was to raise per capita energy consumption from 0.66 tons, or roughly 53 percent of the world average, to 2.1 tons, which is roughly equal to world per capita consumption. Over the same period the structure of energy supply also changed. The share of coal declined from 84 to 37

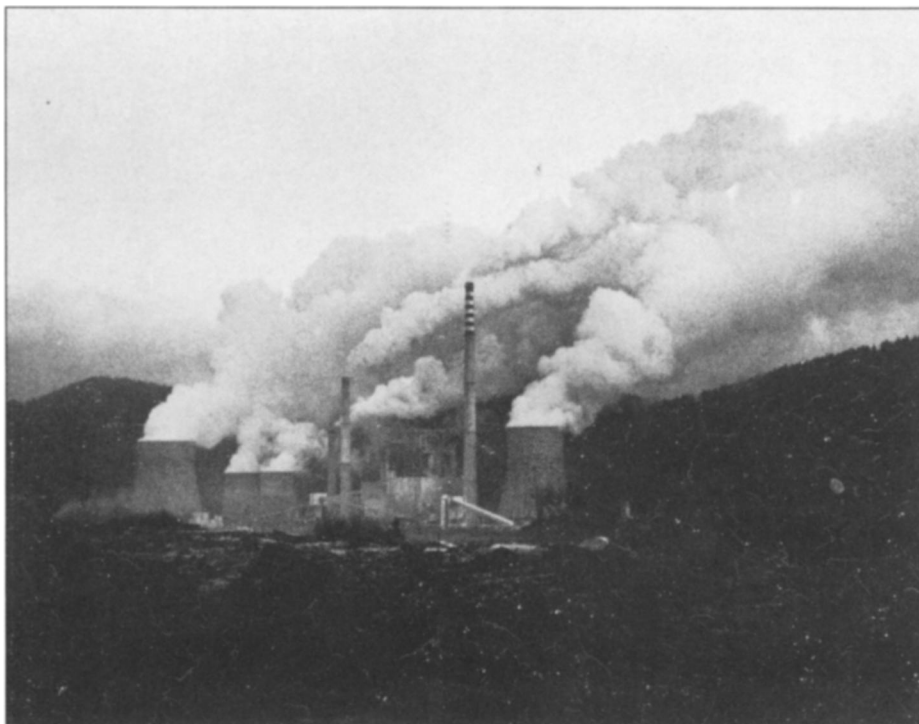
percent, while that of all other sources grew: oil from 13 to 51 percent; natural gas from 0.4 to 6.3 percent; and hydropower from 4 to 7 percent (22). The dramatic increase in the use of oil resulted from the urbanization and economic modernization that the country was undergoing. This included a massive expansion of road, air, and river transport, along with the conversion of rail transport to diesel power; intense growth in the ranks of private autos, with the annual rate of increase running at 25 percent from 1965 to 1973 (23); the substitution of road for rail transport, with the latter declining in freight transport from 75 to 38 percent and in passenger transport from 84 to 11 percent over these two decades (3); the mechanization of agriculture, and; the construction of oil-fired electricity generating plants (22).

Total output of energy in Yugoslavia rose from 10 million tons of coal equivalent in 1957 to 26.3 million tons in 1979, with an average rate of increase of 4.5 percent per year (22). Yugoslavia progressed from being a poor and largely undeveloped country, virtually self-sufficient in energy (85 percent), to a dynamically growing economy, dependent on foreign sources for almost half (47 percent) of its primary energy. Oil increased from 6 to 24 percent of the total output. Only low quality domestic lignite exceeds oil in the share of domestic supply (36 percent of the total).

Yugoslavia imports some 24 million CE tons of its total energy consumption of 49 million CE tons. The great majority of this is made up of liquid fuels (20 million CE tons) the bulk of which is crude oil. Over the past ten years there has been a steady and steep rise in the worldwide price of energy, primarily that of oil. Since the value of net energy imports has grown faster than the value of total exports, the burden on balance of payments, caused by energy imports, has rapidly increased (22). By 1983, crude oil imports accounted for 12 percent of the total value of imports, and all energy imports, including petroleum, coal, coke, and natural gas, accounted for over a quarter of all imports (2).

Yugoslavia responded to the rise in the price of oil by trying to expand domestic-energy production. By the mid-1970s the

Air pollution in Slovenia. A thermo-electric-power plant at Šoštanj. This plant causes the greatest air pollution in Slovenia. Annual emission of sulfur dioxide is 124 000 tons. Photo: Fotoklub "Zrno" Titovo Velenje.



focus was on coal-fired and nuclear generation of electricity. One nuclear-energy plant was in operation by that time (11). By 1983 federal policy emerging from the Kraigher Commission outlined a transition from oil and hard coal to domestic solid fuels with an increasing use of lignite at the center of the forty-year energy plan (2). Projections of energy supply show the share of imported energy in total consumption declining from 47 percent in 1981 to 26 percent in the year 2000. According to the long-term energy plan domestic coal should cover all but four percent of projected coal needs by the year 2002, with coal output rising at 4.9 percent per year. From the point of view of environmental protection, the unfortunate aspect of this plan is its reliance on domestic lignite, a low caloric fuel. Use of lignite implies a greater discharge of pollutants per unit of energy (23).

ENERGY CONSERVATION

Spurred by the need to strengthen its balance of trade, Yugoslavia adopted stringent measures to reduce the consumption of imported fuels. Following the 1973–1974 oil crisis the government relied on the steep rise in energy prices, coupled with public exhortations for conservation measures to curb growth in energy consumption. Since 1974 oil-price increases have been passed on to the consumer and coal prices have been allowed to rise in order to encourage coal production. After the rise in oil prices in 1979 the government introduced more restrictive measures to reduce the country's dependence on oil and to promote the production of coal and hydropower. Construction of power plants that used oil was restricted and industrial projects that relied heavily on energy and oil were penalized (24). New policies prohibited the use of trucks for the transport of goods for distances of over 100 kilometers where railway transport was available (25).

Some elements of Yugoslavia's energy conservation policy, such as the transfer of freight transport away from trucking and back to railroads, amounted to a fundamental alteration in the structure of the economy, reversing a 25-year trend (26).

Operating on an already quite lean energy budget it is not clear how energy consumption can be reduced without cutting into the modest domestic prosperity. The intention is not to reduce gross energy use over the long run, but rather to increase it, relying on domestic sources. The Kraigher Commission's figures show energy requirements rising from the roughly 60 million CE tons per year that characterized the early 1980s to 70–73 million in 1990, 102–119 million in the year 2000, and 210–264 million in the year 2020 (2). Whether Yugoslavia can generate the massive sustained investment that a forty-year quadrupling of energy use will require is open to question. What is clear is that the tremendous growth in fossil-fuel consumption this entails will lead to enormous costs because of the deterioration in air quality, devastation of natural and man-made resources, and effects on human health.

ENERGY AND POLLUTION CONTROL

There are a number of technical strategies which countries can use to reduce emissions of pollutants, including increased energy-use efficiency; shifts to cleaner fuels such as low-sulfur coal or natural gas; desulfurization of fuel; and post-combustion desulfurization of emissions. Naturally, not all of these methods will be suitable for all countries, and which measures a country is likely to employ depends on specific energy and economic conditions. Yugoslavia's air-pollution policy will be dictated by three energy-supply conditions. First, domestic reserves of natural gas and crude oil are very limited. Second, the strained balance of payments precludes import of oil at the same rate as for recent years. Third, large reserves of low-calorie lignite are available, the use of which bodes ill for limiting the emission of SO₂.

Since cleaner fuel is not domestically available, and its import is largely precluded by economic conditions, any attempt to control emission of pollutants must rely on other prospects. The efficiency with which fuel is used can be heightened by technological improvements or by structural changes in the economy; e.g. rail instead of truck transport, insulation instead of fuel combustion, locally grown instead of transported foodstuffs.

Improvement of process efficiencies is most often a case of investment in replacement capital, something an economy might be forced to trade off against investment in new productive capacity. Scrubbing of fuels or of emissions can be costly. For Yugoslavia, the cost of technological control of SO₂ is likely to be high because of the low caloric value of its abundant lignite, and because it will probably have to purchase advanced scrubbing equipment with scarce foreign exchange. So far, flue-gas desulfurization equipment has not been installed in any of the country's thermal plants, and high stacks are relied upon to disperse pollutants (27).

Yugoslavia's nonfossil-fuel energy supply options are nuclear power and renewable energy resources—sun, water, wind, and biomass—both of which will be developed in the future. The Krsko nuclear power plant in Croatia, a Westinghouse installation, has been in use since the beginning of 1983 and now supplies some three thousand million kilowatt-hours of electricity annually (28). As late as the end of 1985 the Federal Executive Council approved planning of four new reactor plants (29). The nuclear-power program has faltered because of a wavering balance of payments and the steady and striking increase in the cost of nuclear-power systems that has been obvious since the mid-1970s.

The Krsko plant is still the country's only nuclear generating station. Installa-

tion of a second plant has only recently been agreed upon by the electricity generating boards of Slovenia and Croatia. Work on the Prevlaka plant was originally to have begun in 1986, and completed in 1993 (30). Once it is in operation the Prevlaka plant will double the domestically-produced electricity from nuclear power (31). Yugoslavia's nuclear electricity program has been delayed because of major increases in the cost of construction and unresolved safety requirements for both operation and disposal of radioactive waste. The political consequences of the Chernobyl incident have further aggravated the already uncertain status of the nuclear program. International bidding on the construction of the Prevlaka plant administered by the federal authorities was to have taken place in late 1987 (27), but progress is in doubt, since the Croatian parliament dropped Prevlaka from its medium-range plans in mid-1987—largely in response to public reaction to the Chernobyl incident (29). Yugoslavia is not yet deeply committed to nuclear energy and is in a position to avoid dependence on a costly source of energy (32).

Energy experts in the West have proposed renewable sources together with conservation and efficiency increases as an alternative to nuclear and fossil fuels. As costs associated with conventional forms of energy have risen, these technically feasible and once expensive forms of energy have grown in economic competitiveness (33). For Yugoslavia they warrant investigation. Yugoslavia is relatively well endowed with the potential for renewable energy and in a 1982 report on technological development the Kraigher Commission proposed that the "intensive development of renewable energy sources" accompany conventional energy development (28). With only 40 percent of hydropower potential exploited, as opposed to the overall European average of 90 percent, Yugoslavia can still exploit this important source of energy. Opinion at both the republican and federal levels proposes expanded hydropower generation to the year 2000, when increased thermal power generation will take over (34).

Even though forest cutting is on the increase (15.4 million cubic meters in 1980 to 17.3 million in 1983), cutting is still below potential capacity of the forests (35, 36). Therefore, the country is in a position to undertake a coordinated program of biomass production for energy, based on the sustained-yield management of forests. The relatively labor-intensive process of forest management could present at least a partial answer to the present serious unemployment problem—the unemployment rate has been more than 10 percent since 1982 (37, 38). Total biomass energy available from plant wastes (straw, cornstalks, etc.) is estimated at 4.8 million CE tons, or roughly the equivalent of current brown coal production (27). A cursory review of Yugoslavia's topography indicates that much of the land area could be exploited for wind generation of electricity. It is mountainous and has the relatively high prevailing wind speeds required for efficient use of wind-power equipment installed on a mass scale. Similarly, situated

as it is along the Adriatic, with much of the country having a Mediterranean climate, the potential for solar energy development is large. While the capital investment needed for decentralized solar and wind-power installations is still a problem, it is becoming evident that the costs involved can be smaller than for nuclear facilities; moreover supply is guaranteed. Furthermore, because the technology associated with solar and wind-power equipment is relatively common, its production could develop as part of the domestic economy.

POLICY

In Yugoslavia the dominant feature of environmental affairs and policy is its regional character. Decisionmaking on environmental issues is in the hands of the local governments and people of the several republics and autonomous provinces. As a result, policies vary considerably. George Klein has noted that in those parts of present day Yugoslavia, once part of the Habsburg Empire (Slovenia and Croatia), protection of the environment dates back centuries. These areas bear witness to careful husbandry of cropland, forests, and waters. In contrast, areas that were under the rule of the Ottoman Empire (Macedonia, Kosovo and parts of Serbia) even today, show a lack of care and investment (11). These contrasting environmental traditions combine with diverging income levels to create markedly different political and social contexts for environmental policy. Klein suggests that the governments of those republics where conservation has been the norm are more likely to act in support of environmental protection than those in the underdeveloped regions, which are still trying to attract investment and industry (11).

An up-to-date illustration of this situation is the location of the new Feronikal nickel-smelting plant in Glogovac, Kosovo. Completed in 1983, the plant has an annual capacity of 52,000 tons of ferronickel and 12,000 tons of nickel (28). Even if the necessary deposits of nickel ore had been available, it is unlikely that the northern republics would have accepted installation of a factory with this polluting potential. The regional nature of investment planning is obvious in energy development as the developed republics (Slovenia and Croatia) show a steady disinclination to invest in energy projects outside their borders (34).

Yugoslavia's environmental policy-making is shaped by the great degree of legal and administrative decentralization that exists under the system of self management and the extent of public participation in political life. Politics tend to exhibit a remarkable degree of interest-group involvement. "Workers' self-management organs and numerous local bodies are in a position not only to act as pressure groups but also to implement policy. Thus Yugoslavia is the only communist state that has interest groups that are analogous to their Western counterparts, insofar as they may dispose over sizable funds that are derived either from their earnings or their membership. . . . Pressure groups in Yugoslavia consist of lit-

erally thousands of self-managerial and working organizations, which govern the economic life of the country (11)."

The Yugoslav Association of Societies for Clean Air publishes its own air-pollution journal (20). Since the late 1970s, newspapers in the country's major cities have regularly carried reports on the high and harmful levels of air pollution prevailing in Belgrade, Zagreb, Ljubljana, Sarajevo, and Skopje (39). As early as 1973 considerable public controversy was generated over the safety of the Krsko nuclear installation. Zagreb's *Vjesnik u Srijedu* (*Wednesday Herald*) published criticism that led to modifications in the plant's cooling system (11). In May 1986 there was a large demonstration against the planned Prevlaka nuclear plant in the Slovenian capital of Ljubljana in the wake of the Chernobyl accident and the Communist Youth League collected some 120,000 signatures demanding a halt to nuclear power development countrywide (29). In November 1986 a local referendum was held in Ljubljana on the issue of earmarking 1.5 percent of personal income for the next five years for environmental protection. With 72 percent of eligible voters participating the measure was defeated by 56 to 44 percent (40).

According to the federal constitution the federal government is authorized "to regulate the preservation and amelioration of the environment in the interests of the country as a whole." However, its jurisdiction is essentially limited to matters of inter-republican and international concern. Political structure then ensures that varied environmental traditions and widely differing economic development goals will work to form different environmental policies among the regions. Serbia, Croatia, and Slovenia have the most comprehensive legislation, but Slovenia's permissible levels for air pollution are only one third as stringent as those in Serbia and Macedonia. While the Council for the Environment and Regional Planning of the Federal Executive Council recommended a series of countrywide threshold limit levels for air pollution in 1979 only Montenegro and parts of Bosnia-Herzegovina had adopted them by the mid-1980s (41).

The federal government handles water issues that involve more than one republic as well as international waters, but all other issues remain within the jurisdiction of the republics and autonomous provinces. Projects that extend across republican boundaries are settled by means of legal compacts between the republics involved (41). Similarly, authority over management of forests, the financing of water-treatment facilities, and air-pollution control installations rests with local governments, under the jurisdiction of republican or provincial governments. Domestic-waterway pollution issues can take on international character when more than one republic or autonomous province is involved. This was the case in the acute year-long dispute between Kosovo and Serbia which started in June 1986 over the discharge of large amounts of phenols into the Ibar River in Kosovo before it flowed into Serbia (32).

PROSPECTS

To the extent that Yugoslavia has avoided (or failed to achieve) the level of consumption required to sustain modern mass production, it has likewise avoided extreme environmental deterioration. Because many of the consumer goods that are typical of western societies—disposable products, synthetic materials, fancy packaging, and especially the private automobile and the infrastructure it demands—are not available, Yugoslavia has enjoyed a lag in creating a pollution problem. This does not mean that pollution has been entirely avoided. Where private-car ownership, the symbol of personal economic achievement in the East as well as in the West, has grown ensuing problems have been similar. By the early 1970s several cities in Yugoslavia were already experiencing an acute air-pollution problem that has been aggravated by the annual growth in the number of automobiles (roughly 200 000 per year) (39). There is every indication that there will be a rise in the number of vehicles and, consequently, a decrease in

urban air quality. Yugoslavia's international debt and the fact that it must import such a large amount of petroleum will make this a difficult course to pursue, particularly at a time when much of the world is reconsidering the widespread use of the automobile (42).

K.W. Kapp has pointed out that the more an economic system relies on private incentives and private gain, the greater the danger of encountering unpaid social costs, but Leonore Taga has made clear that the reward to enterprises in centrally planned economies is equivalent to the private gain of individuals in market economies (43). With its decentralized market socialist system and the great autonomy enjoyed by the republics and enterprises, Yugoslavia's situation seems to resemble capitalist systems more than socialist. It should come as no surprise then to observe enterprise managers in Yugoslavia, like corporate executives in the West, maintaining their focus on investment and production and letting the diffuse costs of environmental pollution be borne by society

at large. Now that environmental concerns are being discussed, managers of companies may well claim that environmental controls on industry threaten output and raise prices (6). Given Yugoslavia's international debt and the economic stringencies undertaken to deal with it, this type of argument might appeal to some segments of the population.

However, there is one inescapable difference that arises from the disaggregation of Yugoslavia's economy and polity that works to mitigate this potential condition. Locating legal authority in small republics and localities institutionalizes responsibility both for the well-being of the area and for the spillovers caused by the activities of individual companies. Each commune and region has then greater control over the outcome of environmentally costly decisions and considerably less opportunity to place the blame on extreme decisionmakers. Thus, the powerful impetus toward regional economic growth can be tempered by strong concern for regional welfare in environmental matters.

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