

The Eastern Atmosphere

From: J. Salay, The Eastern Environment



*The environmental pollution which is
a legacy of the planned economies
in Central and Eastern Europe
still remains to be faced*



The Swedish
NGO Secretariat
on Acid Rain

THE EASTERN ATMOSPHERE

A digest of parts of

THE EASTERN ENVIRONMENT

by

Jürgen Salay

AIR POLLUTION AND CLIMATE SERIES

General editor: Reinhold Pape. Production: Per Elvingson.

THE EASTERN ATMOSPHERE

Digest and typographical design: G. Howard Smith.

Cover photo: Hans Östborn.

ISBN: 91 558 5451-6

Printed by Williamssons Offset, Solna, Sweden 1993.

Further copies can be obtained free of charge from the Swedish NGO
Secretariat on Acid Rain, Box 245, S-401 24 Göteborg, Sweden.

The Eastern Atmosphere

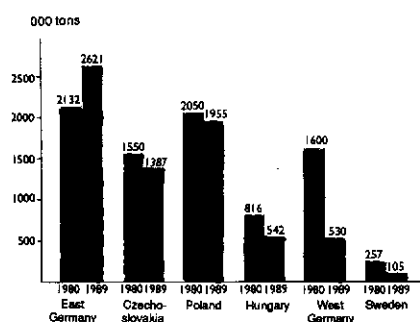
When speaking about air pollution in eastern Europe, attention inevitably fixes on the main pollutant, sulphur dioxide. Here the three great culprits have been East Germany, Poland, and Czechoslovakia. Moreover most of the emissions come from an area known as the Black Triangle, where the three countries meet, which is not much larger than Rhode Island, America's smallest state. In the late eighties some 7 million tons of sulphur dioxide were being poured out every year from this part of Europe. That was more than all the emissions from Britain, France, and West Germany put together. The total emissions from eastern Europe, including Hungary, were then about double this amount.

When calculated according to land area and population, the differences between eastern and western Europe appear even greater, as can be seen from the charts. The figures represent estimates, some of which have turned out to be too low. There is in any case no doubt but that the eastern European countries are the greatest emitters of sulphur dioxide in Europe.

The reason is that coal, often of poor quality, is their principal source of energy. They have little in the way of oil and natural gas, only Hungary producing oil on any scale. That country is also the only one of the four in eastern Europe that derives any appreciable proportion of its energy from nuclear plants. And the only big source of hydroelectric power is to be found in Slovakia's questionable diversion of the River Danube.

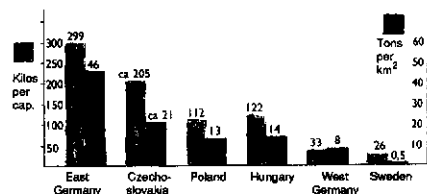
In 1989 coal provided 55 per cent of the energy supply in Czechoslovakia, 71 per cent in East Germany, and 76 per cent in Poland, but only 21 per cent in Hungary, where almost 30 per cent derived from

Emissions of sulphur dioxide, 1980 and 1989, expressed as amounts of sulphur.



Source: EMEP, Oslo 1990. Figures are from national reports to the EMEP.

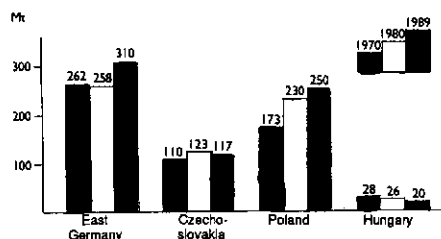
Emissions of sulphur dioxide per capita and km².



Source: Załozenia polityki energetycznej polskiej na lata 1990-2010. Ministerstwo przemyslu, Warszawa 1990.

Up to 95 per cent of the electricity is generated in coal-fired plants.

East European coal production, 1970-1989 (million tons).



Source: ECE Economic Survey of Europe 1988-1989.

oil and a like amount from gas. The proportion of these two latter fuels in the total energy supply was 34 per cent in Czechoslovakia, 25 per cent in East Germany, and 22 per cent in Poland – almost entirely covered by imports from what was then the Soviet Union.

Eastern Europe has thus been obtaining the greater part of its energy from domestic sources. East Germany for instance in 1988 was meeting 71 per cent of its needs in this way, as compared with 35 per cent in West Germany. The method makes economic sense only if energy can be won more cheaply from domestic sources than from imports. That was however not the case in eastern Europe. In that same year, for example, Poland was using 20 per cent of its national income to meet energy needs. Japan on the other hand, a country that has to import almost all of its fossil fuel, needed to use only 4 per cent.

During the eighties, coal output in eastern Europe increased by about 10 per cent, due entirely to developments in East Germany and Poland, the biggest producers. In East Germany output rose by 20 per cent, from 258 million tons in 1980 to 310 million in 1989. An increase of 9 per cent in Poland brought the total there to 250 million tons. Although there was practically no increase in Czechoslovakia, the amount of coal mined was still relatively high: 117 million tons. Hungarian output fell by as much as 30 per cent, to a mere 20 million tons.

The four eastern countries differ not only in the amount of coal that is mined, but also in what kind of coal it is. In East Germany it is entirely brown coal, and it is mostly this type in former Czechoslovakia and Hungary. In Poland on the other hand about two-thirds of the coal mined is hard coal. Since it contains more water than hard coal, brown coal has a lower energy value, so that two to three times as much brown coal has to be burnt to obtain the same amount of energy.

Brown coal is obtained mostly by opencast mining, hard coal by deep mining, often to depths of several hundred metres. While East Germany has most of the open pits, there are also some in what was Czechoslovakia and in Poland. To get at the brown coal, vast quantities of soil have first to be removed. Between 1971 and 1988 brown-coal mining laid waste some 567 square kilometres of farmland and forest in East Germany. Nearly a hundred villages have been razed, more than 30,000 people evacuated, and 70 kilometres of rivers and streams diverted from their courses. Although large areas of opencast have been backfilled, the soil has usually become unfit for cultivation.

The brown coal may either be burnt as it is in power plants or made into briquettes for industrial or household use. In either case it has a damaging effect on the environment. Fly ash and heavy metals, as well as sulphur, are released when it is burnt in power plants, and dewatering in briquette-making produces polluted effluents.

The increased mining of brown coal during the eighties has meant that the best qualities have been used up. Reliance on the lower qualities that are now available means that ever greater quantities have to be burnt in order to maintain energy outputs at the desired levels – which in turn results in ever greater outpourings of air pollutants.

In eastern Europe electricity has always been produced mainly by burning coal. A number of oil-fired power plants were put into operation during the seventies, but when supplies from Russia were later reined in, and prices rose, the share of coal in the production of electricity again increased. Efforts were made to meet the increasing demand by installing more nuclear capacity, inevitably with Russian plant, but without any great success. By 1987, 83 per cent of the East German power was still coming from coal-fired plants. In Czechoslovakia it was 65 per cent, and in Poland an amazing 95

per cent. In Hungary only 32 per cent of the electricity was then being produced by burning coal.

The greatest consumer of power in eastern Europe is Poland. In 1988 that country used 148 terawatt-hours. The consumption in East Germany that year was 120 TWh, in Czechoslovakia 89 TWh and Hungary 40 TWh. Per unit of population, however, East European consumption lies far below the average for western Europe – and compared with Sweden, with its abundant supply of hydroelectric and nuclear power, the eastern European countries use three to four times less per inhabitant.

The demand for electricity rose strongly in the seventies and eighties, and to meet it the East European countries spent a lot on expanding capacity. The system remains faulty, however, still failing to maintain a steady, reliable supply. Almost all the power stations built under the old regime were coal-fired condensing plants of outdated design. A modern coal plant for combined heat-and-power production will utilize up to 80 per cent of the energy contained in the fuel. The eastern European plants, which are not designed to produce heat, have a much lower efficiency. The average efficiency of a coal-fired plant in East Germany at the end of the eighties was only 26 per cent, far below that of a similar West European one (not producing heat either).

There are also a lot of old plants still in operation – some being more than fifty years old. With aged plants there is a greater risk of breakdowns in the power supply, nor can they be kept in operation for as many hours per year as a modern installation. The average operational time for East German and Polish coal plants was 20 per cent lower at the end of the eighties than for West German plants. There were also losses in distribution, amounting to 11 per cent in Poland and 8 per cent in East Germany, as compared with 4 per cent in West Germany.

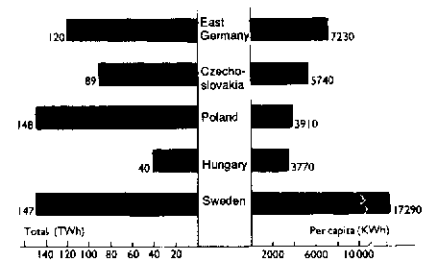
The effects of coal burning in terms of air pollution vary according to the emission source. Most of the emissions of sulphur dioxide, between 60 and 70 per cent, emanate from coal-fired power plants. There are individual plants emitting almost half a million tons of sulphur dioxide a year – more than twice the total amount emitted in Sweden alone. Among the other polluters are manufacturing industries, which often have their own plants for the production of power and heat, and residential heating.

Flue-gas cleaning is on a very primitive level both in power production and manufacturing industries. Although dust filtering was general, at the end of the eighties there was not a single plant of any size with scrubbing equipment in the whole of eastern Europe. The emissions of sulphur dioxide and other gaseous pollutants have simply gone on unrestrained. To reduce the effects in the immediate vicinity of the plants, lofty smokestacks were built, sometimes as much as 300 metres high. Consequently the chief local polluters are often small heating plants. Central heating is relatively uncommon in eastern Europe, where small coal-fired stoves are the usual form of domestic heating. On windless days in urban areas, especially in winter, there will therefore be very large concentrations of pollutants in the air, and not least of sulphur dioxide. There is another effect of the enormous burning of coal in the great emissions of carbon dioxide. The widespread focusing of attention on the contribution of this gas to global warming only adds to the pressure on eastern European governments to reduce their emissions from coal burning.

The eastern European emissions of nitrogen oxides are on the whole hardly greater than elsewhere. Taken together per unit of population they average out to something like the same level as those in Sweden or West Germany. Whereas in western Europe passenger cars are the main source of this form of air pollution, cars constitute

Most of the emissions of sulphur dioxide come from coal-fired power plants.

Electricity consumption, East Europe and Sweden 1988.



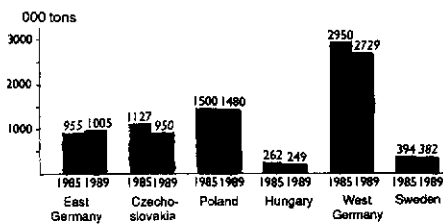
Total consumption = domestic production – exports + imports. For Sweden and Czechoslovakia domestic production only.

Sources: ECE Economic Survey of Europe 1988-1989. National Statistics. OECD in Figures 1990 (Sweden).

Great emissions of carbon dioxide are another effect of burning so much coal.

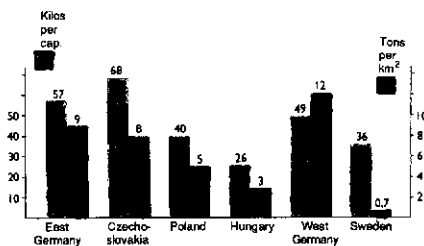
*Inefficient use of energy
revealed by high energy intensity
in industry and transportation.*

Emissions of nitrogen oxides, 1985 and 1989, expressed as amounts of NO₂.



Source: EMEP, Oslo 1990. Figures are from national reports to the EMEP.

Emissions of nitrogen oxides per capita and km².



Source: Załozenia polityki energetycznej polskiej na lata 1990-2010. Ministerstwo przemysłu, Warszawa 1990.

*Failure to promote energy
saving leaves burden on
the environment undiminished.*

less of a problem in the east because fewer people own them. The reason that eastern emissions nevertheless differ little per inhabitant from those in the West lies in the fact of coal being burnt so extensively in eastern Europe.

Energy is also being used inefficiently in the East. Although the amount consumed per inhabitant differs little from that in the West – and is even lower than in Sweden – this is no real indication of how efficiently energy is being used. In other words, of how energy-intensive the various activities are. One way of gauging energy intensity in any country is to calculate the amount of energy needed to produce some value or some product, such as a ton of steel, say, or cement. As regards steel, 10-20 per cent more energy goes to produce one ton in eastern Europe than, on the average, in the OECD countries. While this method is adequate to reveal the efficiency of some production process, it fails as a means of showing how efficiently energy is being used in the whole of the economy.

Some Polish economists once calculated that the energy intensity in eastern Europe was 50 to 150 per cent higher than the average in the OECD. But the difference between East and West has also increased in the last twenty years. Between 1970 and 1985 the OECD countries reduced their energy intensity on an average by 25 per cent, and Japan theirs by 35 per cent. In eastern Europe there was an opposite trend. There are however differences from country to country. At the end of the eighties Hungary was using energy most efficiently and East Germany least.

Not only have the eastern European countries had a general economic structure that made for a wasteful use of energy, but wastefulness has characterized each individual sector. Industry, and especially heavy industry, has been burdened with antiquated plant and outdated technology. Mining and power production are notable examples. There have also been extraordinary losses from the heating of workplaces and homes, due to hopelessly inadequate insulation. A great number of homes – in the case of East Germany more than half of all the apartments – are heated by simple coal stoves. Such central heating as exists is old and wasteful of energy. For lack of thermostats there is no way of regulating the heat but to open the windows. According to Polish estimates up to 20 per cent of the energy consumption could be saved by improving the insulation in factories and housing.

Another sector with high energy intensity is road transportation. Trucks especially consume far more fuel than they do in the West. The vehicles are overage, and their deleteriousness is compounded by a lack of spares and inadequate maintenance. Passenger cars of eastern-European make also consume more fuel than western cars. Cars are used much longer, too, in the East, their average age in Hungary for instance being ten years.

Arranging a more efficient use of energy is quite the most important task now facing the countries of eastern Europe. They have indeed been reviewing the disastrous policies, based on a heedless burning of coal, that were practiced by the former communist regimes. But if they are to avert the further damage to the environment that a continued indiscriminate use of coal would cause, they will need to devise completely new energy policies. Unfortunately, in the attempt to substitute other sources of energy for coal, they are running up against serious difficulties. For one thing, Russian supplies of oil and natural gas are no longer available in the same amounts as previously or at the same cheap rates.

The eastern countries have at least started to back away from subsidized energy prices, and the closing-down of uneconomic state enterprises, particularly in heavy industry – as planned in Czechoslovakia, Poland, and Hungary, and which is proceeding on a grand scale in East Germany – will doubtless also mean a lessening of the

demand for energy in the short term. But as yet little has been done in any of these countries to promote a general saving of energy through more efficient use. So the burden on the environment remains largely undiminished.

Despite the exceptionally high load of air pollutants, the effects of acidification came to be observed later in eastern Europe than in some other places. A partial explanation is that the bedrock and soils in most parts of eastern Europe are less sensitive to acid rain than, say, in Scandinavia. Nevertheless there are signs that acidification, at least in Poland and the former Czechoslovakia, has now reached serious levels, and it may be said that in general in eastern Europe the situation has rapidly deteriorated during the last few years.

The effects on the environment are most evident in the forests, and surveys indicate a disturbing increase in damage from 1980 onwards. Between 1983 and 1989, for instance, the proportion of damaged trees in East Germany rose from 12 to 54 per cent. At the end of that period damage was found in 74 per cent of the trees on Czechoslovakia, 78 per cent in Poland, and 36 per cent in Hungary. It should be noted however that these figures are for commencing damage, and represent country averages, with marked differences from one part of each country to another.

Geographically the damage is worst in the Erzgebirge and Sudeten mountain regions along the borders of East Germany, the Czech Republic, and Poland. Here there are areas of hundreds of hectares where the forests are completely dead. Growing at elevations of several hundred metres, the trees net the pollutants from the adjacent industrial regions of all the three countries. Moreover the soil here happens to be of just the same sensitive type as in Scandinavia. Liming the soil and replanting with more resistant tree species has not helped much. The damage has gone on. It is not confined, either, to loss of the timber. Since ailing trees lose their ability to hold back the runoff, there arises a double effect of the water table becoming lowered and the soil being washed away as well.

Some shocking descriptions of the state of people's health in the industrial areas have also been coming out of eastern Europe during the last few years. The frequency of respiratory diseases among children in those parts where the air pollution is greatest is for instance several times higher than elsewhere, and that of various types of cancer is higher among workers in the chemical and metallurgical industries than in other groups.

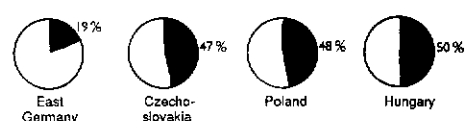
One indication of the state of health is the relatively low level of life expectancy. The average for males in the former Czechoslovakia, Poland, and Hungary is the lowest in Europe, being no more than 65 years. For women in these countries it is also at the bottom of the European scale. Whereas the average life expectancy has been steadily increasing in western Europe since the 1950s, in the East it either ceased to improve or actually declined during the seventies and eighties.

It is difficult to determine exactly how much of this deterioration is due to environmental causes. Consideration must also be given to many other factors that influence living conditions. People smoke much more in eastern Europe than they do, for instance, in Scandinavia, and alcohol consumption is also higher. Among the other factors that should probably be taken into account are poor nutrition and inferior medical care. It may be noted, too, that although the men do not live as long, the women in eastern Europe have an equally hard life. Nearly all of them work, often full time, and do most of the household chores. They also have none of the modern conveniences to which women in the West are accustomed.

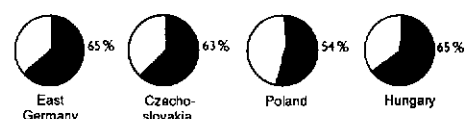
Despite favourable circumstances, there are signs that acidification is now reaching serious levels.

Imports and exports of airborne sulphur.

Percentage of deposition from foreign sources.



Percentage of domestic emissions that is exported.



Source: EMEP, Oslo 1990.

Effects of air pollution on health indicated by the frequency of disease and low life expectancy.

East Germany

East Germany has been the greatest emitter of sulphur dioxide in Europe. In the later 1980s its annual emissions were between 5.2 and 5.6 million tons. This amounts to 46 tons per square kilometre of land area and 299 kilograms per inhabitant – surely a world record. At that time too the emissions of particulates were about 2.3 million tons. The leading polluters were the power and chemical industries, the share of the former being 58 per cent for SO₂ and 41 per cent for particulates, and that of the latter being 12 per cent for both. The emission sources are largely concentrated around Halle-Leipzig, the home of the East German chemical industry where there are also many coking plants, and the Cottbus area with a large number of coal-burning power stations. Together these areas accounted in 1988 for 63 per cent of the East German emissions of sulphur dioxide, and 54 per cent of the particulates.

Just south of Cottbus is one of the greatest concentrations of coal-fired power stations to be found anywhere. Here six large plants with a combined capacity of 12,000 megawatts have been emitting almost 2 million tons of sulphur dioxide every year. There was no flue-gas cleaning, only high smokestacks and primitive dust filters. Although it diminished the risk of smog in the immediate vicinity, this simply spread the pollution higher up into the atmosphere.

Emissions of 20 to 25 tons of carbon dioxide per inhabitant per year meant that East Germany at the end of the eighties was leading the world as regards this pollutant. With emissions totalling 350 million tons, the country was one of those in Europe contributing most to the greenhouse effect.

The emissions of nitrogen oxides were said by the East German authorities to amount in 1988 to 700,000 tons, although western estimates put them at one million. Fifty-eight per cent came from stationary sources, and 42 per cent from transportation. Among the stationary sources the power sector was again the chief polluter, accounting for 70 per cent of the total.

At that time the emissions of hydrocarbons amounted to 345,000 tons, of which 1000 tons consisted of freons. East Germany then only accounted for 1 per cent of world consumption of these chemicals.

The quality of the air is worst around Halle and Leipzig where the average yearly concentrations of sulphur dioxide lie between 100 and 150 micrograms per cubic metre. That is three or four times higher than the limit set by the World Health Organization. In Stockholm in 1988 it was 24 micrograms. The amounts of dust particles in the air were also very high in this area, as they naturally were to the south of Cottbus, too, with all those power stations. In fact almost a third of the East German population may be said to have lived with a "superfluity" of sulphur dioxide and particulates in the air.

Ways of curbing the emissions of air pollutants were being considered in East Germany as far back as in the seventies. The only result was the installation of dust filters; no start was made on flue-gas cleaning on any scale. The official energy policy is said to have been to blame. Almost all effort went to increasing production from existing power plants without any changeover to new and better methods of firing. This left a lot of antiquated plants that not only needed to be equipped with filters, but also to be converted to a completely new technique. Even the newest one, that at Jänsch-

walde near the Polish border, which was completed as late as 1990, is designed along the old lines for burning lignite and was thus practically obsolete from the start. It burns up to 100,000 tons of brown coal a day, and covers an area of two square kilometres.

The former East German government did however in the spring of 1990 present an ambitious plan for reducing air pollution. This would have involved a thoroughgoing renovation of all the country's power stations, with a widespread fitting of flue-gas cleaning equipment to small and large plants. The aim was to have reduced the emissions of sulphur dioxide and particulates by as much as 75 per cent by the year 2000. The problem of financing this program was however never solved. The cost of replacing worn-out or obsolescent dust filters alone was put at DM5 billion.

Now, since the autumn of that year, the situation has completely changed. The power supply is in the hands of three very large and five lesser West German electricity companies. Their injection of capital in combination with West German ideas about the limits to air pollution should result in a marked reduction of emissions, at least as regards sulphur dioxide and particulates. Even in the most favourable conditions such a development will however take time, and it is doubtful whether the reduction target of 75 per cent for sulphur dioxide can be attained as early as 2000.

The general problem of air pollution will be further complicated by the expected expansion of road traffic in the former eastern part of the country – something that the West has been having to contend with for quite a long time.

In the Erzgebirge mountain region along the Czech frontier the average yearly concentrations of sulphur dioxide in the air are between 80 and 100 micrograms per cubic metre, with peaks of more than 1000 micrograms – and it is here that the worst forest damage is to be found. Other places where the forests are badly affected are the Harz and the Thüringerwald regions on the old border between East and West Germany, although there the concentrations have not been by any means as high as in the Erzgebirge.

Even with West German ideas and capital, it is doubtful if target reduction of sulphur dioxide can be realized.

Czech and Slovak Republics

Reckoned per square kilometre, Czechoslovakia has been the next greatest emitter of sulphur dioxide in Europe. After having steadily increased until around the mid-eighties, the emissions stabilized at about 3 million tons a year. The figure for particulates was then about 2.8 million tons. Electricity generating and manufacturing industry account for almost 80 per cent of the totals. Most of the emissions of these two air pollutants occur in northern Bohemia and further east around Ostrava, in the Black Triangle region. The cities of Prague, Brno, and Bratislava are also heavy polluters. In these parts of the country the levels per square kilometre are two to three times higher than the national average.

In northern Bohemia there is a huge agglomeration of mines and power plants. From an area comprising no more than six per cent of the country came almost 40 per cent of its electricity, 75 per cent of

Most of the emissions of sulphur dioxide and particulates come from the Black Triangle.

Results of an increasing use of brown coal in the last twenty years clearly seen in the statistics.

Especially important to reduce the pollutant load in northern Bohemia, with its agglomeration of lignite mines and power plants.

its brown coal, and 60 per cent of its uranium. About a third of the Czechoslovakian emissions of sulphur had their sources in the power plants and industries of northern Bohemia. The lignite used for the production of electricity is of low quality, which means that the emissions of solid particles are especially polluting. The dust that is spread from the burning of the local brown coal – mostly in the form of fly ash – contains many harmful substances, including arsenic, cobalt, nickel, and also some that are radioactive.

In the most polluted parts of the country the average concentrations of sulphur dioxide and particles in the air lie between 100 and 200 micrograms per cubic metre. The emissions from the numerous chemical plants and refineries around Bratislava are of an especially damaging kind. Extremely high levels of pollutants – up to 3000 micrograms per cubic metre for sulphur dioxide – have been recorded in northern Bohemia and the city of Prague. The towns in northern Bohemia are generally situated in valleys, which makes them especially vulnerable during periods of inversion. The results of the increasing use of lower qualities of brown coal during the last twenty years can be clearly seen in the statistics. The concentrations of sulphur in the air of northern Bohemia more than doubled for instance between 1970 and 1985, and the worsening has been noticeable even out in the countryside. The background levels of sulphur dioxide in these parts now lie between 10 and 20 micrograms per cubic metre.

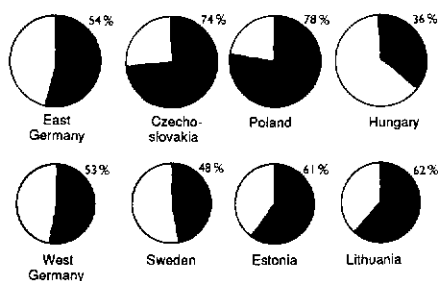
Flue-gas cleaning has been largely neglected. While it may be found sporadically in some of the smaller industrial undertakings, it is entirely lacking at power plants and in domestic heating systems. Dust filtering became if anything worse in the eighties, when worn-out equipment was not replaced to a sufficient extent. Projects that were started with Russian and West German aid to install flue-gas cleaning at some power and industrial plants in the latter half of the decade got little further than the pilot stage.

The intention of the new regime in the Czech Republic has been to make the abatement of air pollution a priority – the main effort being directed to reducing the use of brown coal in power plants and manufacturing industries, as well as converting the latter to more energy-efficient processes. It will be especially important to reduce the pollutant load in northern Bohemia, where 70 per cent of the lignite is mined and most of the power plants are located. The output of the brown-coal mines is expected drop from something over 90 million tons in 1990 to 52 million by 2005, although this may depend on whether the supply of natural gas from the Russian Commonwealth can be increased.

The plan is also to shut down some coal-fired power plants with a capacity totalling at least 2000 megawatts by 2005. At the same time two new nuclear plants with a combined capacity of 5760 megawatts will be put into operation, raising the nuclear share of the power supply from 28 per cent in 1990 to at least 55 per cent by 2005. There were already more atomic reactors in operation in Czechoslovakia than anywhere else in eastern Europe, there being eight altogether. Doubts about the safety of some of these Russian-built reactors, especially that at Jaslovské Bohunice only 100 kilometres from the Austrian border, may however delay the whole program. But no matter whether the authorities choose to keep the old reactors running, or build new ones, it will be in any case expensive.

Czechoslovakia was among those countries of Europe with the worst damaged forests. Practically all the northern part is marked by forest decline, with dead stretches on the high ground all along the German and Polish frontiers. The country is also the only one in eastern Europe where there is extensive acidification. Four-fifths of all the farmland is in some way acidified, and in the mountain region northwest of Ostrava pH values of 2.0 have been recorded in the soil,

Forest damage 1989.



Percentage of trees, broadleaved and coniferous, with more than 10 per cent defoliation. For Sweden only coniferous. The Estonian and Lithuanian figures refer only to specified areas.

Source: Acid News, 4/1990.

which is far below the level where trees can grow. And everywhere almost all the mountain lakes are now acid.

The health situation also gives cause for alarm. In Bohemia and Moravia more than half of the population is said to be living in areas with unhealthy levels of pollution. Whereas in 1965 Czechoslovakia lay tenth among a group of twenty-seven European countries as regards life expectation, by 1987 it had slipped to almost last place. Cancer is increasing at a rate of 2 per cent a year, and at the end of the eighties the frequency was higher in Czechoslovakia than in any of the other UN member countries. Some scientists believe that every fifth person in the country is suffering from some illness caused by environmental pollution.

Poland

Poland has been the next largest emitter of sulphur dioxide in Europe, its outpourings in the eighties having run to at least 4.3 million tons a year. In terms of land area and population these emissions were however only about half those of Czechoslovakia, amounting to 13 tons per square kilometre and 112 kilograms per inhabitant. The emissions of particulates in Poland were put at 3.4 million tons a year. As in the case of its neighbours to the west and south, the greater part of the pollution emanates from power generation and manufacturing industry, which together account for about two-thirds of the total. Just under a quarter of the sulphur and a third of the dust particles come from domestic heating. The mining and manufacturing area of Silesia is inevitably the greatest polluter.

Power plants are answerable for almost half of all the country's emissions. The world's largest plant fired with brown coal is that at Belchatow to the southwest of Warsaw. With a capacity of 4320 megawatts, it is estimated to emit more than 400,000 tons of sulphur dioxide a year – a figure that rises to 1.5 million tons when the emissions of nine other large plants are added. The Polish plants are however more widely spread over the country than those in the former Czechoslovakia and eastern Germany.

Poland is the greatest emitter of carbon monoxide in eastern Europe, churning out about 3.2 million tons a year. Its emissions of nitrogen oxides are estimated to run at 1.5 million tons, and those containing hydrocarbons at close on half a million. As regards carbon dioxide, Poland's emissions are the greatest in all Europe – amounting, according to estimates made by Polish scientists in 1990, to at least 500 million tons a year. Eastern Europe's contribution to the greenhouse effect is once more underlined.

As in eastern Germany and Czechoslovakia, extensive coal burning leads to the release of considerable quantities of heavy metals to the atmosphere, and the steelmaking and metalworking industries add further amounts. The estimates are only rough, but suggest 700 tons of arsenic, 1200 tons of chrome, 200 tons of cadmium, 30 tons of mercury, and 4500 tons of lead.

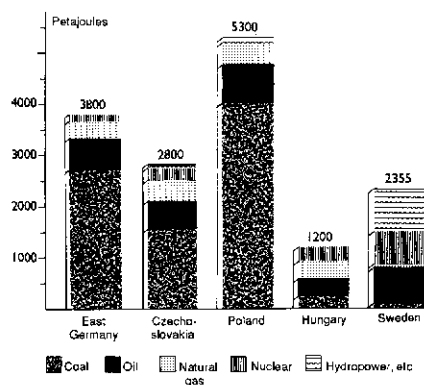
The emissions of all types of air pollutants increased steadily throughout the eighties. The increase was however especially noticeable in the case of sulphur, due to an increase in the number of power plants burning brown coal. By 1989 a third of the country's electricity was being generated in such plants. Poland has also suffered from the pollution borne in from eastern Germany and Czechoslovakia. The concentrations of sulphur dioxide in the air over half of Poland

Most of the emissions of air pollutants come from the generation of electricity and manufacturing industry.

Noticeable increase in emissions of sulphur, due to more power plants burning brown coal.

Aim is to reduce sulphur dioxide emissions by 30 per cent by the year 2000, and another 30 per cent by 2010.

Sources of energy, eastern Europe and Sweden 1989					
Percent from each source	GDR	CSFR	Poland	Hungary	Sweden
Coal	71	55	78	21	5
Oil	17	21	14	28	29
Natural gas	8	13	8	29	0.6
Nuclear	4	9	-	21	28
Hydroelectric, misc. domestic fuels	-	2	2	-	38
Consumption per capita (GJ)	228	182	141	114	278



The figures from Sweden are from OECD statistics for 1988. Those for nuclear power in East Germany and Hungary include small amounts from hydroelectric sources ($\leq 0.5\%$).

Sources: PlanEcon Energy Databank, OECD in Figures 1990.

Meeting the increased demand for electricity by more efficient generating can eliminate the need for more capacity.

exceed 32 micrograms per cubic metre. That means, essentially, the whole country west and south of Warsaw. In some mountain areas in the far southwest the concentrations are more than 64 micrograms, and there is nothing there but dead trees.

The air pollution varies greatly from season to season and from place to place. Worst affected is the region west of Katowice in the far south. There the average concentrations of pollutants such as sulphur dioxide, dust particles, and heavy metals are on a level with those in northern Bohemia and some East German cities. Mines, coking plants, and steelworks often lie within city limits, so that residential areas, schools, and hospitals are all the time exposed to polluted air.

In 1986 the Communist government of the time appointed a commission to work out proposals for reducing the emissions of sulphur dioxide and nitrogen oxides. The scheme it put forward two years later called for a reduction of sulphur dioxide by 1.7 million tons by 1995, and a further 3.4 million tons by the year 2000, with corresponding reductions for nitrogen oxides of 0.4 and 0.9 million tons. This would require enormous investments in new firing and flue-gas-cleaning techniques in power generating and manufacturing, totalling 500 billion zloty at 1988 prices.

This was actually the first program put forward in eastern Europe for improving the quality of the air. Although obviously utopian, it did lay the foundation for the attempt of the new government after the fall of communism to get to grips with the problem of air pollution. According to the new plan published in 1990, a reduction of the emissions of sulphur dioxide would only be possible after 1995. First the country should either try to develop its own methods of flue-gas cleaning or start production of equipment of foreign design on a licensing basis. Then a reduction of 30 per cent should be the aim for the year 2000, followed by a further 30 per cent by 2010.

The intention is that by 1994 the emissions of nitrogen oxides shall have been brought down to their 1987 level, and thereafter be reduced by 10 per cent to 2000 and a further 50 per cent by 2010. By 2010, too, hydrocarbons, organic compounds, heavy metals, etc., should be contained at levels below the accepted standards. All industrial and power plants, as well as large heating installations, should be fitted with efficient gas-cleaning equipment, and lead-free petrol should have become standard by 2000.

Whether these aims can be achieved will depend rather naturally on developments in the energy sector. As a result of the new economic policy, leading among other things to greatly reduced production in heavy industry, by 1990 energy requirements were already lower by 16 per cent than they had been in 1988. Assuming an economic growth of 5 per cent during the next ten years, by the year 2000 these requirements would be about 5 per cent higher than in 1988. Consequently there would be little need to increase the production of energy.

More efficient use of energy will, it is said, enable the production of hard coal to be reduced from the 190 million tons of 1988 to about 140 million by the year 2000. The share of coal in the production of energy would then be reduced by 5-10 percentage points—the reduction being compensated by increased imports of oil and natural gas.

By 1990 the consumption of electric power had declined like that of energy in general. By 2000 however the demand for electricity is expected to have risen from 144 to 176 terawatt-hours. Since it should be possible to meet this increase through more efficient generation in coal-fired plants, no increase in installed capacity should be needed before the year 2000. Only towards the end of the nineties will it be necessary to decide whether the increased need of electricity is to be met by nuclear power or some other form of energy.

The Polish plan is the most ambitious attempt in eastern Europe to set up a national energy program. But as in the case of the other

eastern European countries, the need for investments in the energy sector is very great. It was calculated in 1985, for instance, that the cost of modernizing the distribution network for electricity alone would run to 260 billion zloty, or one-quarter of all the money allocated for the energy sector for the five-year period from 1986 to 1990. There are on the other hand great savings to be realized. According to Polish economists the proposed modernization of the distribution network would increase the available energy by an amount corresponding to the output of 1500 megawatts from a big new power plant.

Despite the great expense, modernization of the energy sector could also yield great savings.

The need for improvements is obvious. In twenty-seven areas of the country, comprising 11 per cent of the land surface, the ecosystem has been seriously damaged by various types of pollutant. Here live 13 million people, or about 35 per cent of the population. Five of them, with a combined population of six million, have been designated as areas of ecological catastrophe, and they include the heavily industrialized region around Katowice in Upper Silesia, the copper-mining areas of Legnica in the southwest, and the cities of Cracow and Gdansk.

The health situation is reminiscent of the Czechoslovakian. In 1983 the Polish Academy of Sciences reported that male life expectancy was already lower than it had been ten years previously. Between 1960 and 1985 the deaths per thousand had risen from 7.6 to 10.3. Respiratory diseases and cancer are 50 per cent higher in Upper Silesia than in the other parts of the country. In and around Cracow infant mortality is between 25 and 30 per thousand – six times higher than in Sweden, and presumably the highest in Europe.

Poland has the largest area of any east European country, and consequently there are great regional variations in the amount of forest damage. Worst hit are the southwestern parts, where all the coniferous trees are in some way damaged, and there are great stretches of completely dead forest. Outside Jelenia Gora, for instance, 10,000 hectares of dying coniferous forest have had to be cleared. On more than half of the country the concentrations of sulphur dioxide in the air are at least 20 micrograms per cubic metre, usually considered to be the limit at which conifers begin to be affected.

Concentrations of sulphur dioxide are often at limit where damage to conifers begins.

Hungary

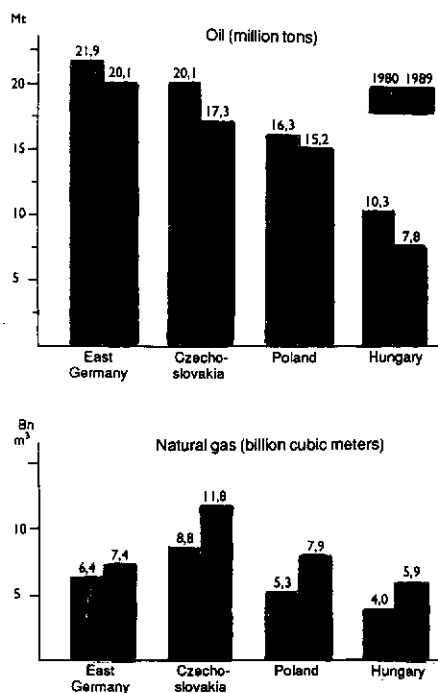
Hungary differs from the other eastern European countries in that the sources of energy weigh more equally. Nor are its emissions of air pollutants as great as those in the other countries. Nevertheless on a basis of area and population they are about on the same level as the Polish, in the case of sulphur dioxide amounting to 14 tons per square kilometre and 122 kilograms per inhabitant per annum. In 1988 the emissions of sulphur dioxide came altogether to 1.4 million tons and those of particulates to 500,000 tons. The estimates for carbon monoxide and nitrogen oxides were 1.4 million and 300,000 tons.

The respective sources of pollution are the same as in eastern Europe generally, manufacturing and power production being far and away the most dominant. Together these two are responsible for something like two-thirds of the emissions of sulphur dioxide, dust particles, and nitrogen oxides. Domestic heating accounts for about

As elsewhere in eastern Europe, power generating and manufacturing are chief sources of air pollution.

While the use of fossil fuel is unlikely to diminish, the aim is to reduce emissions by other measures.

East European imports of oil and natural gas from USSR (CIS).



Source: PlanEcon, June 8, 1990.

High estimate of the cost of illness and absenteeism due to a polluted environment.

a fifth of the substances containing sulphur and the emissions of dust, and a third of all the country's emissions of nitrogen oxides comes from transportation, mostly road traffic.

Air pollution occurs principally in that half of the country lying north of a line from Lake Balaton to Miskolc at the eastern end. Here lie, besides the capital, Budapest, some ten industrial centres with mines, steelworks, and power plants. One place outside this area where the air is also bad is the mining centre of Pecs in the far south of the country. In all these cases the average concentrations of sulphur dioxide in the atmosphere lie between 50 and 70 micrograms per cubic metre, or somewhat less than those in the worst affected industrial areas of, say, Czechoslovakia, but nevertheless well above any acceptable levels, and the same applies to other types of air pollutant. Although the sulphur emissions declined somewhat in the course of the eighties as a result of burning less coal, and there was a general improvement in air quality in some places, by 1990 no noticeable reduction of the overall emissions could be observed.

Despite a great dependence on imports of all forms of energy except coal – oil, gas, and electricity – Hungary has, in contrast to the other eastern European countries, been relatively successful in its energy policy. Hungarian officials are however cautious in their estimates of the possibilities of reducing air pollution during the nineties, saying that the proportion of fossil fuels in the energy supply is hardly likely to diminish, and that it will take time to install all the necessary cleaning equipment. The government's aim is to reduce pollution by means of a number of subordinate measures affecting the power and industry sectors. These measures are to include reducing the content of sulphur and other pollutants in fuels, and installing more efficient firing and flue-gas cleaning equipment.

Hungary has some resources in the form of coal, oil, and natural gas within the country. The coal is however mostly brown coal of low quality, and mining is being phased out. Although the production of oil and gas is expected to diminish somewhat, the supplies will still be sufficient in 1995 to cover 20-25 per cent of the country's need for these types of fuel. The rest has previously been met by large imports from the Soviet Union. But now that these are uncertain, alternative sources are having to be sought.

Unlike the other eastern European countries, Hungary has also been importing great quantities of electricity from Russia. In 1989 such imports, amounting 11.1 terawatt-hours, accounted for 28 per cent of Hungarian consumption, but here again uncertainty as to the future is making it necessary to look for other sources of supply – especially as requirements are expected to rise by 1-1.5 per cent per annum towards the end of the nineties.

At present barely a third of the needed power comes from the country's one nuclear plant at Paks, just south of Budapest. Here are four reactors, each with a capacity of 440 megawatts. An order for two additional reactors of 1000 megawatt capacity from Russia having been cancelled, and work on two medium-sized hydroelectric plants on the Danube having been stopped, the choice now lies between more nuclear power and a combination of coal and gas firing. Without foreign aid, however, financing new projects will be difficult.

The damage from air pollution still remains. A good 40 per cent of the population, or 4.3 million people, are now living in cities with heavily polluted air, and Hungary comes close to the bottom of the list in European statistics concerning life expectancy. Deaths among middle-aged men have been steadily increasing during the last twenty years, and are now highest in Europe. Almost half of all male deaths are due to cancer. Although it is difficult to prove the connection between air pollution and mortality, the pollution is just there where people mostly live. Economists calculate the annual economic

loss from illness and absenteeism due to the polluted environment to amount to the equivalent of \$300 million.

The damage to forests is not as great as in other parts of eastern Europe, most of it occurring, as might be expected, in the northern half of the country. Hungarian scientists have on the other hand found that 13 per cent of the soils are acidified – although this is not so much due to airborne pollution as to the enormous use of nitrogen fertilizers.

The Baltic States

As regards air pollution, the situation in the Baltic States differs from that in eastern Europe generally. Here there are altogether 7.8 million people on a land area a third larger than, say, East Germany's, where there were twice as many inhabitants. Despite considerable urbanization and development of industry during the period of Russian occupation, farming, including forestry, still remains the predominant productive sector. There is no heavy industry, the main single sources of pollution being power plants. In Latvia and Lithuania the greatest polluter of the air is, somewhat oddly, road traffic.

And yet 62 per cent of the forest generally in Lithuania has been found to be in some way damaged, and 61 per cent of the coniferous woodland in Estonia to be definitely so. In Lithuania most of the deposition consists of pollutants that are swept in by the winds from East Germany, Czechoslovakia, and Poland. Both Latvia and Lithuania suffer, too, from the emissions in the Ukraine and White Russia. Estonia on the other hand is a net exporter of pollution, chiefly on account of a great burning of oil shale for the production of electricity.

Oil shale is the source of half of the energy consumed in Estonia, and half of the country's electricity supply comes from shale-fired plants in its northeastern corner adjoining Russia and the Gulf of Finland. But these plants also account for 70 per cent of the Estonian emissions of air pollutants, and this puts the country in a dilemma, since half of the power they produce earns currency by being exported to Latvia and Russia. Cutting down on the exploitation of this resource would also bring social consequences that might be difficult to manage.

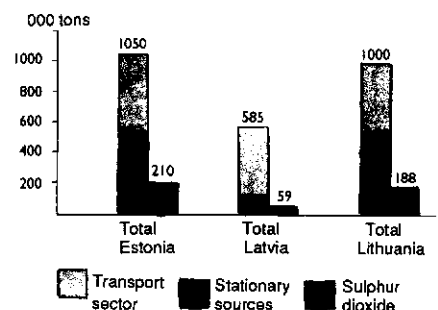
Of the three Baltic states, Estonia and Lithuania are by far the largest emitters of air pollutants, the Latvian emissions being much lower. This is because 70 per cent of the electricity generated in Latvia comes from three hydro plants, and half of the power consumed is imported. In Latvia, too, the emission sources are more widely dispersed than in the other two countries, especially Estonia.

The emission total is high in Lithuania despite the country's being able to cover half of its power needs from the nuclear plant at Ignalina. The largest stationary source of air pollution is the combined heat-and-power plant at Elektrenai between Kaunas and Vilnius.

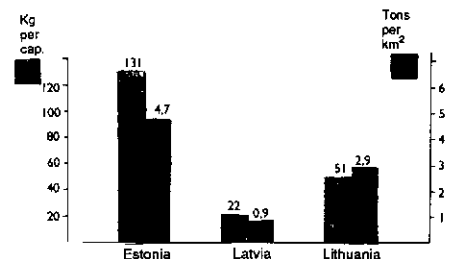
The main overall pollutants are various kinds of particulates, as well as sulphur dioxide. Here again the biggest emitters of the latter are Estonia and Lithuania. Of Estonia's total emissions of 1.1 million tons in 1989, about a fifth consisted of sulphur dioxide. Counted per capita this is equal to the Polish level, which thus puts them amongst the highest in Europe.

Need to earn foreign currency stands in the way of improvement by the one net emitter.

Emissions of air pollutants in the Baltic States.



Emissions of sulphur dioxide.



Sources: Environment '89. Estonian Nature Management Scientific Information Service, Tallinn 1990. Environmental Statistics yearbooks for Latvia and Lithuania.

Editor's postscript

In the Environmental Action Programme for Central and Eastern Europe, the European environmental ministers judged air pollution to be the most urgent immediate problem. In *The Eastern Environment*, Jürgen Salay has depicted the situation as it appeared at the beginning of the present decade. Now, two years after publication, it remains essentially the same. Jürgen Salay did however warn against expecting any rapid improvement, saying bluntly that we should be prepared for a long-drawn-out period of effort to bring about change. And it appears he was right. For one thing the governments of the countries concerned have been very much occupied with the process of reform from a planned to a market economy. Western initiatives for aid have, too, often come to nothing, and for various reasons, such as the offers having been dependent on the use of western technology, carried out by western firms, and deemed unsuited to the local conditions, and also because of a lack of institutional capability in the recipient countries to make quick use of the proposed loans. Any reduction of the emissions of polluting substances that has so far been noted may, consequently, be largely ascribable to economic decline, due on the one hand to the disappearance of previously existing markets and on the other to the slow build-up of new ones. Some groundwork for improvement has however been laid, especially on the eastern side, which should take effect with a pick-up of the economy. In the meantime we can only concur in a statement of a representative of one of the international development banks – that what is now needed is a strengthening of institutional capacity and a greater emphasis on small-scale investments that can be carried out quickly.

Reinhold Pape

The Secretariat

The Swedish NGO Secretariat on Acid Rain was formed in 1982 with a board now comprising one representative from each of the following organizations: The Environmental Federation, the Swedish Anglers' National Association, the Swedish Society for Nature Conservation, the Swedish Youth Association for Environmental Studies and Conservation, and the World Wide Fund for Nature Sweden.

The essential aim of the secretariat is to promote awareness of the problems associated with air pollution, and thus, in part as a result of public pressure, to bring about the required reduction of the emissions of air pollutants. The eventual aim is to have those emissions brought down to levels – the so-called critical loads – that the environment can tolerate without suffering damage.

In furtherance of these aims, the secretariat operates as follows, by

- ☐ Keeping under observation political trends and scientific developments.
- ☐ Acting as an information centre, primarily for European environmentalist organizations, but also for the media, authorities, and researchers.
- ☐ Publishing a magazine, *Acid News*, which is issued five times a year and is distributed free of charge to some 5000 selected recipients.
- ☐ Producing and distributing information material.
- ☐ Supporting environmentalist bodies in other countries by various means, both financial and other, in their work towards common ends.
- ☐ Acting as coordinator of the international activities, including lobbying, of European environmentalist organizations, as for instance in connection with the meetings of the bodies responsible for international conventions, such as the United Nations Convention on Long Range Transboundary Air Pollution.
- ☐ Acting as an observer at the proceedings involving international agreements for reducing the emissions of greenhouse gases.

The work of the secretariat is largely directed on the one hand towards eastern Europe, especially Poland, the former Czechoslovakia, and the Baltic States, and on the other towards members of the European Community, in particular Great Britain. By emitting large amounts of sulphur and nitrogen oxides, all these countries add significantly to acid depositions over Sweden.

As regards the eastern European countries, activity mostly takes the form of supporting and cooperating with the local environmentalist movements. Since 1988, for instance, financial support has been given towards maintaining information centres on energy, transport, and air pollution. All are or will be run by local environmentalist organizations.

JÜRGEN SALAY wrote *The Eastern Environment* (Swedish title *Östeuropas miljö*) to show the difficulties facing the eastern European countries in their attempts to get to grips with the problems of environmental pollution. The reason he chose to deal with East Germany, the Czech and Slovak Republics, Hungary, and Poland in the first place was that the problems were worst there, but also because the move to democratic rule and economic reform had come furthest, and so more information was available than elsewhere in eastern Europe.

Jürgen Salay, a social scientist, spent four years, prior to writing *Östeuropas miljö*, concentrating as a researcher and consultant on the problems of energy and the environment in eastern Europe. He has been actively engaged in cooperation between Sweden and the countries of Central and Eastern Europe in matters concerning the environment and has spent lengthy periods in the former Soviet Union as well as in the countries whose state he has described here.

