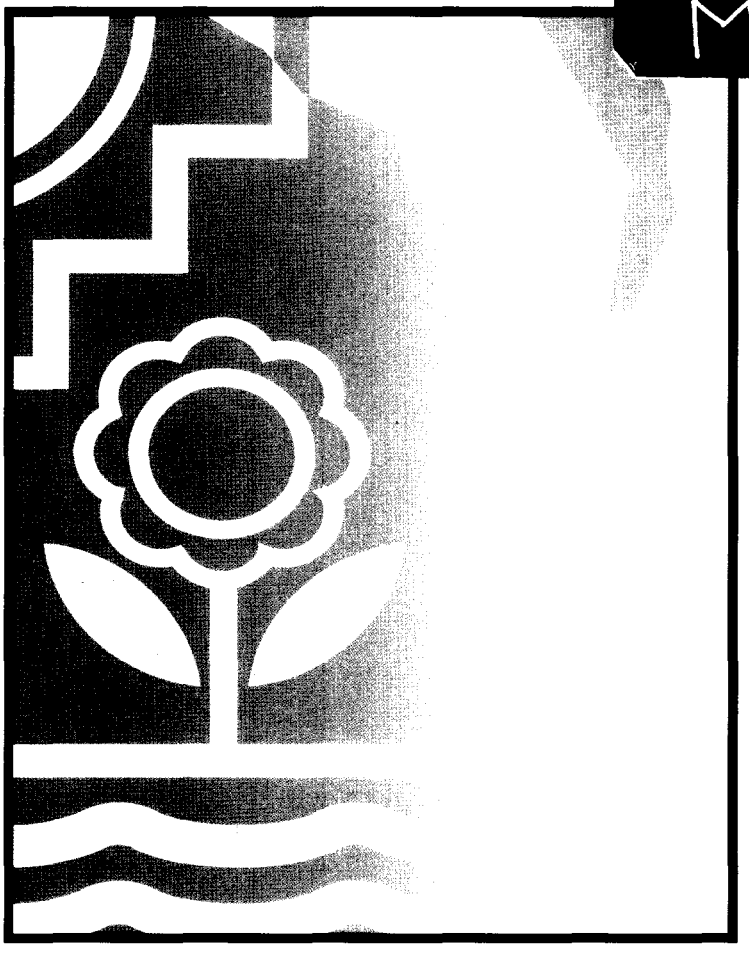
ENVIRONMENTAL ACTION PROGRAMME FOR CENTRAL AND EASTERN EUROPE

SETTING PRIORITIES



ABRIDGED VERSION OF THE DOCUMENT
ENDORSED BY THE MINISTERIAL CONFERENCE
LUCERNE, SWITZERLAND, 28-30 APRIL 1993

Environmental Action Programme for Central and Eastern Europe

Setting Priorities

Abridged Version
of the Document endorsed by the
Ministerial Conference

Lucerne, Switzerland
28–30 April, 1993

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Preface to the 1994 Edition

At the Ministerial Conference "Environment for Europe," which took place on 28-30 April 1993 in Lucerne, Switzerland, Ministers "endorsed the broad strategy, with its principles and general priorities, contained in the *Environmental Action Programme for Central and Eastern Europe* (EAP) as a basis for action by national and local governments, the Commission of the European Communities and by international organisations and financial institutions and private investors active in the region" (Paragraph 6 of the Ministerial Declaration, 30 April 1993).

This endorsement was the culmination of a two-year process of discussion and consensus building among representatives from about 30 Eastern and Western countries and numerous international institutions in the framework of the Swiss-led Expert Group established after the Dobris Conference in June, 1991. From a different perspective, the endorsement was the beginning of a substantive dialogue which is based on a much better understanding of how to achieve tangible results in a situation where serious environmental problems must compete with many other grave social and economic demands.

The great achievement since the Dobris Conference, however, goes well beyond the preparation of the Action Programme, for there has been a shift in understanding of how it might be possible to achieve the greatest possible environmental improvements with the available resources. There is now a recognition that improvements in the environment are rooted in economic and social change, not in isolated investments. Attendance at the Lucerne Conference reflected this new paradigm; not only were environment ministers from 50 countries represented, but many senior finance, economic, and sectoral ministry officials also attended, especially from the 20 participating Central and Eastern European countries.

This Action Programme represents a synthesis of several major studies. As part of a broad consensus building process, they were reviewed by various expert panels and dis- cussed at international meetings prior to the Lucerne Conference. The work was undertaken by the World Bank and OECD under the guidance of a Task Force chaired by the Commission of the European Communities.

The innovative conclusions and fundamental recommendations would not have been possible without the commitment of countless individuals and generous contributions by several governments and institutions. The major studies were funded jointly by the governments of Denmark, Germany, Italy, The Netherlands, Switzerland, the United Kingdom, and the United States; and by the European Commission, the OECD, and The World Bank. The Netherlands Government also financed the editing of the Action Programme. Most important of all, however, was the dedicated effort of a number of the Central and Eastern European countries with whom we embarked on a journey that is bringing us ever closer together in our joint quest for a better "Environment for Europe."

Ruth Dreifuss
Federal Councillor
Head of the Federal Department of the Interior
Government of Switzerland

Yannis Paleokrassas
Commissioner
Commission of the European Communities

Jean-Claude Paye
Secretary-General
Organisation for Economic Co-operation and Development

Lewis T. Preston
President
The World Bank

This Report has been prepared by a team led by Richard Ackermann (World Bank) and comprising Gordon Hughes, Clyde Hertzman, László Somlyódy, Kristalina Georgieva, Wendy Ayres, and Gretta Goldenman. The sections on economic and environmental policies and on forecasting draw upon the work of Rob Maas, Johannes Bollen and Jean-Paul Hettelingh (RIVM) and Michael Toman (RFF). The chapter on expenditure priorities is based on the work of Wynne Jones, Mark Ambler, John Marrow and others working under a contract with Coopers & Lybrand. The section on Transboundary and Global Concerns is based on a draft from Martin Uppenbrink (UNEP), and benefitted from extensive comments and review by Anton Eliassen, Harald Dovland, Mari Saether (Norway). The sections on biodiversity and nature conservation are based on contributions from Jean-Pierre Ribaut (Council of Europe), Zbigniew Karpowicz and Liz Hopkins (IUCN). Information on the phaseout of Ozone Depleting Substances was provided by Claus Hvashøj Jørgensen and Ulla Blatt Laursen under a contract with COWIconsult. The section on Non-Governmental Organizations includes contributions from John Hontelez, Mara Silina, Martin Kaspar, and Przem Czajkowski. The principal editor was Frances Cairncross.

Many others provided helpful comments and contributions. Brendan Gillespie (OECD) and Anna Bramwell (EU Commission) provided major inputs; and valuable advice was received from members of the Task Force, Expert Group, and others, in particular Alexander Avertchenkov, Dan Beardsley, Thomas Becker, Ruth Bell, Quincy Berengère, Lars Björkbom, Jan Boehringer, Anders Boheman, Philippe Bourdeau, Philippe Bourel de la Roncière, Ralph Brieskorn, Giuseppe Cassini, Guy Clausse, Andrzej Czyz, Andriy Demydenko, Jeremy Eppel, Hermann Escher, Andrea Fennesz, Duncan Fisher, Richard Fort, Alexander Goudyma, Ronald Greenberg, Hugo Haider, Hans-Joachim Hermann, Theresa Herzog-Zimmermann, Paul Hofseth, Adam Isaacs, Oreola Ivanova, Jonathan Klavens, Miklos Koloszar, Zsuzsa Lehoczki, Kurt Lietzmann, Thomas H. Litscher, Bill Long, Måns Lönnroth, Ralph Luken, Sheila McKinley, Timo Mäkela, Margita Mastrovic, Alexander Melzer, Brian K. Muehling, Branimir Natov, Marek Novakowski, David W. Pearce, Grzegorz Peszko, Istvan Pomazi, Tue Rohrsted, Theodore E. Russell, Wilhelm Schmid, Karsten Skov, David Stanners, Daniel Stauffacher, Jernej Stritih, Ulf Svidén, Josue Tanaka, Stanislaw Tarkowski, Daniel Thompson, Jan Thompson, Istvan Tökes, Hubert Menalda van Schouwenburg, Luis Veiga da Cunha, Ulla Weigelt, Henry Wyes, Harvey Yakowitz, André Yatchinovsky, and Anthony Zamparutti.

Valuable advice was received from colleagues in the World Bank, including especially Wilfried Thalwitz, Anil Sood, Marcelo Selowsky, Anand K. Seth, Robin Bates, Kathleen Stephenson, Anders Halldin, Helmut Schreiber, Bilal Rahill, Stephen Lintner, Nicole Glineur, Piotr Wilczynski, Peter Whitford, Mark Kosmo. Laszlo Lovei and David Wheeler were Peer Reviewers.

The Action Programme and the many related administrative tasks depended critically on the tireless assistance of Lucie A. Albert, Johnson Appavoo, Nathalie Lenoble, Jennifer Sterling (World Bank), and Anne Cariou and Leonora Lynch (OECD).

A full draft of this report was discussed with Central and Eastern European governments in the course of a series of missions in March/April 1993. These missions were led by representatives from Austria, Denmark, Germany, The Netherlands, Sweden and the United Kingdom.

Many thanks go to Jürgen Gneveckow, Lousewies van der Laan, and Bo Libert for their efforts to obtain translations of the Action Programme; to Stanislaw Sitnicki, Alexander Juras and Colin Woodard at the Regional Environment Center for organizing the translation and dissemination in Eastern Europe; and to all the countries and institutions sponsoring the translation and dissemination process. The EAP is being translated into 19 Central and Eastern European languages.

The work program and the many studies leading up to this Environmental Action Programme for Central and Eastern Europe (EAP) were first described in a document entitled "Setting Environmental Priorities in Central and Eastern Europe." Many of the issues raised in that document are taken up in greater detail in this report and in the technical reports issued separately.

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Technical Reports (issued separately)

This report represents a synthesis of a two-year process involving numerous studies, detailed technical reports on the most important topics, joint meetings, workshops and international conferences. Following is a list of the major reports and conferences:

Environment and Health in Central and Eastern Europe

Monograph evaluating the influence of environmental pollution on human health in comparison with other determinants of health in 12 Central and Eastern European countries. The document summarizes the current knowledge about locations

in the region where environmental pollution is known to have influenced human health, and identifies the principal types of environmental exposure which are affecting human health and could be subject to remediation through concerted environmental action. A draft of the report, which was prepared for the World Bank, was discussed at a high-level meeting of health and environment officials sponsored by WHO, UNEP and the World Bank at the WHO Regional Office for Europe in Copenhagen (Denmark), March, 1993.

Environmental Liability and Privatization in Central and Eastern Europe

Book analyzing the legal and economic issues associated with questions of environmental liability in the privatization process. The document, prepared by the World Bank, is based on an international conference on privatization, foreign direct investment and environmental liability hosted by the Polish Ministry of Environmental Protection, Natural Resources and Forestry in Warsaw in May, 1992. The Conference, which was organized jointly by The World Bank, OECD and EBRD, brought together ministers, deputy ministers and other high-level officials responsible for privatization or the environment in 13 Central and Eastern European countries, as well as representatives from the private sector and the international community.

Foreign Direct Investment and Environment in Central and Eastern Europe: A Survey

Survey of large European and North American corporations to assess the importance they attach to environmental issues in deciding whether to invest in Central and Eastern Europe. Preliminary results of the survey, which was carried out by The World Bank and OECD, were discussed at the Conference on Privatization, Foreign Direct Investment and Environmental Liability in Warsaw (Poland) in May, 1992.

Priorities for Environmental Expenditure in Industry

Extensive report analyzing expenditure options which offer the most cost-effective immediate environmental improvements in particular industrial sectors. The report contains an inventory of polluting plants in 12 Central and Eastern European countries and is based on detailed case studies in the following sectors: Power and district heating, refineries and petrochemicals, inorganic chemicals, organic chemicals, iron and steel, non-ferrous metals, pulp, small boilers and households.

Municipal Wastewater Treatment in Central and Eastern Europe: Present Situation and Cost-Effective Development Strategies

Report evaluating municipal wastewater treatment in Poland, the Czech Republic, the Slovak Republic, Hungary and Bulgaria. Data were assembled for 362 municipalities with a total population of 35 million (about half the total population of the five countries, and 70% of the total urban population). The data cover all towns with populations greater than 25,000 and in Poland some additional towns greater than 10,000. The data from all five countries were assembled into a single computerized data base which was combined with an analysis of different technologies to evaluate the present status in the countries and to determine the cost of different approaches to upgrading existing wastewater treatment facilities. The report was discussed at a workshop at the International Institute for Applied Systems Analysis in Laxenburg (Austria) in March, 1993, and was attended by experts from the five countries studied.

Scenarios for Economy and Environment in Central and Eastern Europe

Report analyzing five specific scenarios of economic restructuring and the resulting environmental effects. The document reviews in particular the implications for environmental policy and different requirements for capital renewal. The air pollution emissions of the different scenarios are translated into Europe-wide maps of pollutant concentration and deposition levels. The report was discussed in detail during a workshop on economic restructuring and environment organized by the Government of Hungary in cooperation with UN/ECE and OECD and with the participation of the World Bank and the Netherlands Institute of Public Health and the Environment (RIVM) in March, 1993 in Budapest (Hungary). The workshop was attended by experts from 18 countries.

Energy and Environment in European Economies in Transition—Priorities and Opportunities for Co-operation and Integration

Proceedings of an OECD/IEA Conference held in June, 1992 in Prague. The Conference report discusses the need for integrated policies for energy and environment that will address the major problems in both sectors effectively and efficiently. The report describes specific actions for policy integration, including: market-based energy pricing; actions to overcome barriers to energy efficiency; integrated energy-environment strategy development; inter-ministerial cooperation; and innovative funding mechanisms. The Conference brought together representatives of Central and Eastern European gov-

ernments, of OECD Member countries and of international organizations, and executives from private companies and public utilities.

Alternative Policy Instruments for the Control of Air Pollution—Case Study of Poland

Report analyzing the potential effectiveness and efficiency of alternative policy instruments to control air pollution in Poland. The work was supported by the Polish Ministry of Environmental Protection, Natural Resources and Forestry (MOSZNiL) and was carried out jointly by Polish and international experts. The analysis focused on the likely gains to be achieved from applying economic instruments to control emissions of sulfur dioxide, nitrogen oxides, and particulate matter (i) at a national level, and (ii) in a specific geographical area (the city of Krakow). The results were presented and discussed at a workshop held in Warsaw in October, 1993. The workshop was organized by MOSZNiL and the World Bank and was attended by representatives of the environmental offices of most Polish provinces (Wojewodships), by provincial and national representatives of the state inspectorate of pollution control, as well as by Polish and international experts.

Environmental Information Systems and Indicators: A Review of Selected Central and Eastern European Countries

Report analyzing the collection and use of environmental information in Central and Eastern European countries, based on case studies carried out in Poland, Hungary, and the former Czech and Slovak Federal Republic. The report also presents key environmental indicators for these countries in the same comparable framework used by OECD Member countries. These country case studies and their recommendations were discussed by officials from central and eastern European countries, OECD Member countries, and international organizations at a workshop held at OECD in December 1991. A similar monograph on environmental information systems and indicators in Belarus is also available.

Taxation and Environment in European Economies in Transition

Report of an OECD workshop that examined the scope for reconciling fiscal and environmental policy objectives in economies in transition, including the use of taxes and charges on pollution and environmental damage. The report includes case studies of Estonia, Hungary, Poland, and the Russian Federation. The OECD workshop concluded that, although a number of Central and Eastern European countries already use environmental taxes, considerable scope remains to adapt and expand their use in the transition to a market economy.

Economic Reform, Industrial Restructuring and the Environment

This paper, which is being prepared by the World Bank, examines the relative contribution of supply and demand factors to prospective changes in emissions of key air and water pollutants in Central and Eastern European countries over the next 10–15 years. It develops a model of industrial growth and structural change to analyze the impact of various environmental policies as well as the environmental implications of broader economic factors including macroeconomic adjustment, market reforms, privatization and trade liberalization.

Agriculture and the Environment in the Transition to a Market Economy

Report based on an OECD Conference held in September 1993 in Vilnius, Lithuania. The Conference brought together both agriculture and environment officials and experts to discuss environmental problems related to agriculture and to consider ways for countries in transition to integrate their policies for agriculture, environment, and rural development, based on recent methods and experiences tried in OECD Member countries.

Further Preparatory Meetings

In addition to the meetings at which the above reports were discussed, a number of other international workshops were organized to stimulate discussion and to generate consensus on some of the main elements in the Action Programme:

Economic Instruments for Environmental Policies

This meeting discussed the OECD Guidelines and Considerations for the Use of Economic Instruments in Environmental Policies. The meeting recognized that opportunities existed for the more effective application of economic instruments in transition countries, and that market-based instruments in combination with regulations could help integrate environmental considerations into the process of economic restructuring. The workshop was organized by OECD and UN/ECE in Geneva, December, 1991.

Environmental Policy and the Transition to a Market Economy in the Newly Independent States

This seminar examined four key issues that underlie the Environmental Action Programme for Central and Eastern Europe: economic restructuring and the environment (focusing on energy issues); privatization, foreign direct investment, and environmental liability; resource pricing and economic instruments; and low-cost technological improvements in highly polluting industries. The seminar was held in Minsk (Belarus), December, 1992. It was hosted by the State Committee for Ecology of the Republic of Belarus and was organized by OECD.

Executive Summary

As adopted at the Ministerial Conference*
28 April 1993

Introduction

The Environmental Action Programme (EAP) has been developed in response to a call by Ministers from east and west at their 1991 Conference, and in the spirit of the United Nations Conference on Environment and Development (UNCED). Despite efforts by Central and Eastern European (CEE) countries to tackle environmental problems, sometimes with international assistance, there are still a number of serious environmental problems which require immediate and urgent action.

This Executive Summary presents an overview of the Action Programme and describes the main features of the broad strategy and action framework that the Programme represents. This strategy is based on a "three-legged" approach of policy reform, institutional strengthening and investment. The Action Programme illustrates a range of actions that could be taken to implement this strategic approach. The Programme concentrates on short-term, immediate action, but ensures that these actions are consistent with longer-term economic, social and environmental objectives.

Why an Environmental Action Programme?

The resources available for environmental improvement in the countries of Central and Eastern Europe, including the Former Soviet Union, will be severely constrained over the next 5–10 years. The costs of meeting some environmental objectives will, however, be very high. The Environmental Action Programme provides a framework and guide for identifying the highest priority problems; and for developing realistic, efficient and cost-effective solutions. It is intended as a basis for each country in Central and Eastern Europe to set its own national environmental priorities, and to improve and promote cooperation between and among Eastern and Western countries.

The main constraints to implementation arise from a general lack of financial and above all institutional capacity rather than from issues that are specific to particular environmental problems or potential solutions. Hence the most urgent problems will only be solved if clear goals are established at the outset and the most efficient way to achieve each goal is identified. This appraisal of priorities, risks and benefits is an essential prerequisite for a sustainable development strategy which identifies investments and policies in support of a socially and ecologically sound objective, thus avoiding the need for costly remedies *ex post*.

Some of the most significant environmental improvements will be achieved through so-called "win-win" policies and investments: these can be justified entirely on economic grounds, but also entail substantial environmental benefits. Improvements in energy and other resource efficiency are good examples.

The major environmental problems—Criteria for setting priorities

Priorities should reflect the urgency and importance of environmental concerns. Setting environmental priorities involves making difficult choices.

The damage to human health caused by poor environmental quality is the first concern in the region—as was the case in the West when major environmental health threats were first addressed. Initial evidence suggests that the following types of environmental pollution have affected human health (and also causing economic damage) *in particular areas* in CEE:

- Lead in Air and Soil from lead and zinc smelters and from transport;
- Airborne Dust from household furnaces, small-scale enterprises, power and heating plants, metallurgical and other large plants;
- Sulfur Dioxide and other Gases, especially in combination with dust.

Other important health impacts arise from:

* The Executive Summary has been left unchanged, whereas the main text has been edited and updated since the Ministerial Conference.

• Nitrates in water from inadequately maintained/designed feed lots and agricultural enterprises, inappropriate fertilizer application, and rural septic tanks;
• Contaminants in food and water, especially where heavy metals or toxic chemicals threaten drinking water supplies either directly or through poor disposal of hazardous/nuclear waste.

But human health is not the only criterion to set priorities. In certain areas, the following are of major significance:

• productivity losses caused by damage or destruction of physical capital and natural resources; and
• the deterioration of or threat of irreversible damage to biodiversity in general, and in particular to wetlands (lakes, reservoirs, rivers), grasslands, coastal and marine ecosystems, forests and mountain habitats.

Finally, priority might also be attached to low-cost/high gain measures to address issues of growing importance in the medium-to-long term and where there may be a long lead time to effect changes (e.g., transport).

Each CEE country must decide how the resources can be best allocated to remedy the problems that it regards as having the greatest priority, bearing in mind that the above problems have been generally recognized as the most serious concerns in Central and Eastern Europe.

The scarcity of resources does not just imply that environmental investments should be scaled down. Rather, the benefits of broad economic policies should be captured, and a judicious mix of different technologies, management, institutions, and policy approaches applied. An important question that should be asked is: "How much environmental improvement can be achieved at different costs?" The answer will provide the flexibility to achieve the best result for the available resources.

Establishing priorities involves a combination of the following complementary measures:

• better *economic and environmental policies;*
• *expenditures that are carefully targeted* to projects with high benefit to cost ratios; and
• *institutional development and capacity building,* including training, education, and exchange programs.

These are described in the following sections.

Policy Reforms

Economic Policies

The transition from central planning to a market economy should not only improve the countries' economic performance in the longer term, but will contribute to environmental improvements by penalizing the massive waste of resources—and the resulting pollution—which characterized production in the past. Among the key factors that can bring about economic and environmental improvements are restrictions on access by enterprises to government money ("hard budget constraint"), and removal of subsidies on natural resources such as energy, minerals, or water. Many CEE countries have already made major strides in reducing energy subsidies. These efforts should be—and are being—continued.

How environmental priorities may evolve over time

The analysis in this report highlights *air pollution,* especially that caused by particulates, as the highest environmental priority for Central and Eastern Europe. However, environmental priorities will change as the policies, structural changes and investments discussed in this report mitigate some environmental problems and make others worse.

Preliminary analysis suggests that air pollution will dramatically improve as a consequence of higher energy prices, the fall in the output of the metallurgical sector, and investment in new capital equipment with better environmental controls. For *water pollution,* the prospect is much less rosy. Over three quarters of BOD emissions come from municipal (household) sources, so that general progress in raising the dissolved oxygen level of rivers depends upon better municipal sewage treatment, which will be too costly for national and local governments to afford for some time to come. Discharges of heavy metals and chemical pollutants are largely an industrial problem whose solution depends on industrial investments in suitable pre-treatment methods. Such investments will not necessarily be undertaken in response to simple policy changes such as higher energy prices or even pollution charges.

The projections discussed in this report suggest that the output of the food processing, wood products, paper and chemical industries—all significant sources of water pollution,—will grow much faster than that of the building materials, metallurgy and electricity industries. The balance of industrial emissions will, therefore, shift towards water pollution and away from air pollution.

The effects of industrial change on the disposal of *solid wastes* is mixed, since the total volume of such wastes will decline—primarily because mining will decline—but there is likely to be increasing problems in dealing with hazardous wastes unless low waste technologies are rapidly adopted.

As living standards begin to recover, both the size and use of the automobile fleet are likely to grow quickly. The result will be increasing photochemical smog and ozone exposure. The volume of municipal waste will also rise rapidly as consumers begin to expect packaging standards equivalent to those in Western Europe.

The benefits attached to reducing environmental damage will also alter. As the worst of the health problems associated with air pollution are resolved, the amenity benefits of a clean environment will gradually become more important. This will focus attention on improving water quality for recreational purposes (i.e., sewage treatment) and on better visibility (i.e., vehicle emissions).

These considerations suggest that the primary focus of environmental policy will shift over the next decade from air pollution from stationary sources towards water pollution from both industrial and municipal sources, vehicle emissions and the management of solid and hazardous wastes.

In chapters III-VI, the EAP identifies the most appropriate short-term measures in light of expected longer-term developments.

Declining economic activity has brought substantial reductions in emissions. Market reforms should allow these environmental improvements to be sustained or extended over the next decade by promoting a shift towards less resource-intensive and cleaner activities and technologies. As the industrial capital stock is renewed, emissions of most air pollutants—other than those associated with traffic—can be kept stable or even reduced until 2010 even with quite rapid economic growth. However, emissions of water pollutants will be less affected by industrial restructuring because of the dominant contribution of agriculture, households and services, so that *the focus of attention will shift from air to water in the longer term.*

In certain instances, it may be appropriate to provide incentives for environmental investments by the private sector, such as those that have the greatest potential to reduce major threats to human health or natural ecosystems. However, environmental investments that are made in the industrial and energy sectors should be consistent with least cost planning and policy objectives, and private sector decision-making. More generally, the integration of environmental requirements in the design of sectoral policies is a key factor in environmental improvement.

Environmental Policies

Targeted environmental policies, including a judicious mix of regulations and economic instruments, will be required to ensure that the potential benefits of economic restructuring are fully realized. For example, while removal of energy price subsidies will bring about a reduction in energy use and hence pollution levels, pollution charges can complement these policies by promoting the use of cleaner fuels and technologies.

To achieve the most cost-effective use of resources, economic instruments, such as charges and taxes, should be applied where appropriate. Existing CEE systems of pollution charges can be developed further to provide an effective incentive for sound environmental practices. There is scope for large savings in achieving environmental objectives by applying simple market type approaches which are realistic even in the current economic and institutional situation. There is also considerable scope for reconciling environmental and fiscal policies.

Summary of Principal Recommendations

- *Base environmental priorities on a careful comparison of costs and benefits.* The resources available for environmental improvements will be severely constrained in Central and Eastern Europe for the next 5–10 years. It is essential that limited resources be applied to the most urgent problems first.
- *Implement policies and invest in projects which pro vide both economic and environmental benefits.* "Win-win" polices include removing subsidies that encourage the excessive use of fossil fuels and water in industry, agriculture and households. "Win-win" investments include those in energy and water conservation, low-input and low-waste technologies, and expenditures on "good industrial housekeeping."
- *Harness market forces for pollution control wherever possible.* Market-based instruments, such as pollution charges, fuel taxes, and deposit refund schemes, can help achieve desired levels of environmental quality at much lower costs than traditional regulatory approaches. Regulatory instruments will still be needed to control emissions of some micro-pollutants such as heavy metals—particularly lead—and toxic chemicals.
- *Concentrate on local problems first.* Many people suffer health damage from exposure to lead in air and soil, airborne dust and sulfur dioxide, from nitrates in drinking water and from contaminants in water and food. Solving these problems will do the most to improve health and well-being. Measures to reduce emissions of pollutants in response to local concerns also should contribute to reducing transboundary and global emissions.
- *Donor countries should consider providing funding to accelerate measure to reduce emissions of transboundary and global emissions in countries of Central and Eastern Europe.* Such funding would be particularly appropriate where the marginal costs of reducing emissions are lower in Central and Eastern Europe. Minimizing the net cost of meeting international agreements is in the interests of individual countries as a whole. By lowering the net cost of reducing transboundary flows, countries could afford to act earlier or to adopt more stringent reduction targets.
- *Clarify responsibility for past environmental damage.* Uncertainty about who will be responsible for past damage can discourage foreign and domestic investment and can impede the privatization process. For practical reasons, governments will have to bear most of the costs of dealing with past emissions. Governments must define clearly the environmental standards that new owners must meet and the period of adjustment that will be permitted.
- *Set standards that are realistic and enforceable.* Implement stricter standards over a 10–20 year period, and ensure that industries comply with interim standards.
- *Involve local people in setting priorities and in implementing solutions.* Neither governments nor donor institutions are equipped to judge how local inhabitants value their environment. A participatory approach is essential for the long-run sustainability of environmental improvements.
- *More research, training, and exchange of information are needed to help decision-makers set sensible priorities.* Research should focus on the state of the environment in Central and Eastern Europe. Much more information is also needed on low-cost ways to reduce emissions of air and water pollutants from non-ferrous metal smelters, iron and steel plants, chemical plants, paper mills, and wastewater treatment plants and on ways to conserve biodiversity.
- *Finding, implementing, and financing solutions will require building partnerships.* Transferring know-how and clean technologies will require strong cooperations between East and West, between countries of Eastern and Central Europe, and within countries, between cities, institutions and enterprises.

Regulatory measures

As far as environmental regulations are concerned—for instance to control emissions of heavy metals and toxic chemicals—CEE governments should introduce a *framework* of standards and requirements such as, where appropriate, that adopted within the EC or an equivalent *phased* system like those in effect in the United States, Canada, or other OECD countries. Many internationally accepted standards are being reviewed in light of experience with the aim of improving their efficiency. The framework of standards adopted by CEE countries should provide for the *phased implementation* of increasingly stricter emission limits which, over a 10–20 year period, would approach the internationally recognized standards that will be in effect at that time. Enterprises should be given a well-defined period to comply with new standards which should be strictly enforced. For this reason, both economic instruments and regulatory measures should be accompanied by strong monitoring and institutional enforcement capacity to ensure their effective implementation.

Ambient (i.e., immission) standards should be used as part of a decision framework to guide policy making at the local level. Appropriately set, ambient standards reflect environmental and economic sustainability criteria. In addition, the efforts of several CEE countries to apply biodiversity conservation standards should be recognized and expanded.

Old and new enterprises

Conflict between economic, social and environmental considerations is inevitable, especially when the resources available to mitigate the social or environmental consequences are so limited. Some old and highly-polluting plants will be allowed to continue operating because of the large social costs of closure. Even so, it is possible to insist that such plants improve their environmental performance without committing any significant amount of investment.

Large gains can often be achieved by simple "good housekeeping" measures—better maintenance, repairing leaks, installing better controls, insisting on stricter standards of plant and process management. These are all highly cost-effective "win-win" actions which will improve the economic results of enterprises as well as lessen the environmental damage that they cause. Such small-scale actions underpin the environmental improvements from economic policy transformation. They are essential because much of the large-scale introduction of cleaner technologies in different industrial sectors may not occur until new markets for the different products have been identified, and the economic viability of specific enterprises is assured.

Thus, it is crucial that governments *not* direct all of their resources—human as well as financial—towards new investments or enterprises, since remarkable improvements can be made if the managers of old plants are put under pressure to make continuous improvements and are rewarded appropriately for above average performance. Evidence suggests that the greatest contribution to achieving a continuous decline in total emissions in the short to medium term is likely to come from improving the environmental performance of old plants which continue to operate. Moreover, to achieve conditions equivalent to those in Western Europe, emissions per unit of output equivalent to those obtained by applying Best Available Technology (BAT) would, for the purpose of immediate improvement, only be required in some of the worst "hot spots" and only for some pollutants.

Privatization

Ministries of Environment should work with Ministries of Finance, Industry and Privatization, as well as Health and Social Security, to ensure that environmental considerations are built into decisions about which plants or enterprises in the public sector should be closed and which should be allowed to continue to operate. By affecting the pattern of closures and the conditions which must be met before plants receive assistance to support their continued operation, the environmental authorities can have a significant impact on the damage caused by old plants at a low cost.

Privatization can assist the changes promoted by market reform. Governments can both expedite privatization and facilitate environmental progress by establishing clear rules assigning liability for past environmental damage, and by holding the new ownership of enterprises accountable for all current emissions. In many cases, the government must be willing to assume responsibility for past damage, but there are a variety of ways of structuring that responsibility to provide protection both for the government and for the environment. Environmental audits—which can be carried out without causing significant delay—can be conducted to separate past from on-going pollution. Where privatized enterprises are out of compliance, the enforcement of stricter environmental standards should be carefully phased in.

The transition from central planning to markets may result in irreversible effects on the rich biological and landscape diversity in part of Central and Eastern Europe. CEE countries could be supported through existing international conventions and agreements in their efforts to identify networks of areas of high natural value, to develop policy for protection and sustainable use within the transition process, and to ensure a sustainable, environmentally-sound use of privatized land. Short-term assistance in the provision of extension services in agriculture and forestry, legislation and integrated planning are required to prevent the kinds of developments that have occurred in Western Europe.

Immediate investment priorities

In the *long term*, market reform—especially industrial restructuring—in combination with appropriate environmental measures, will take care of a large part of the emissions causing health and economic damage in the region. This will occur as alternative sources of employment are

found for workers in economically inefficient and polluting industries which need to be closed, and as economic activity picks up and viable enterprises can afford to invest in new technology.

In the *short term,* however, public investment is warranted:

- to speed up the process of environmental improvement where there are social and economic constraints (heavily polluting enterprises are not closed, households cannot quickly respond to increased energy prices and cannot easily shift from coal to cleaner energy sources, etc.); and
- to begin to address environmental problems that will persist after the transition to a market economy (e.g., air emissions from mobile sources).

Environmental investments should only be carried out if the following three categories of expenditures are adequately addressed: recurrent cost financing for Operation and maintenance (especially at the municipal level), environmentally beneficial expenditures which can be justified on economic grounds, and institution building:

- OPERATION, MAINTENANCE, REPAIR, AND SELECTED REHABILITATION OF EXISTING PUBLIC ENVIRONMENTAL SERVICES. Safe drinking water, collection and disposal of municipal waste, well-functioning public transportation systems, and the monitoring of the disposal of hazardous, toxic and nuclear wastes are all vital concerns. These require funds to cover recurrent costs; but they should generally not, *in the short run,* require major new capital investments.
- "WIN-WIN" INVESTMENTS. Small investments (often less than $0.5 million) in energy and water conservation—metering, reducing leakages—, low-input and low-waste technologies, and above all expenditures on "good industrial housekeeping" and minor plant improvements which reduce spills, leaks and material use. These are all investments which are justified on economic and financial grounds alone, but which also have major environmental benefits.
- INSTITUTION BUILDING. Different levels of government need to continue to build up a solid financial and tax base to ensure the availability of funds for meeting recurrent costs; industrial managers should be trained in better management practices; and institutions need to be developed that can in the future make well-informed decisions such as on water-related investments in a river basin framework. Efforts should also continue in promoting environmental topics in school education, and in supporting worker training programs.

Environmental Investments

Once these measures are assured, the priority categories for short-term domestic environmental investments are:

- Immediate investments to address the most serious health problems. In areas with poor *air quality,* the initial priorities should be better dust controls for non-ferrous (lead, zinc, copper, aluminum) smelters and steel plants, and the use of cost-effective cleaner fuels in district heating plants and households. With regard to *water quality,* the priorities are pre-treatment of industrial wastewater, where heavy metals or toxic chemicals threaten the quality of ground or surface waters, and measures to reduce excessive levels of nitrates and microbiological contamination in rural drinking water supplies. For *hazardous wastes,* the priority must be to ensure that leachates from disposal sites do not contaminate ground or surface water sources.
- Measures to deal with problems specific to different countries. These include wastewater treatment to protect valuable coastal, ecological and tourist resources, the phased completion of incomplete wastewater treatment plants where appropriate and *where this will have the most impact on water quality,* and programs to prevent irreversible damage to and loss of productivity of important ecosystems at the domestic and transboundary levels.
- Support to reinforce and accelerate environmental investments by enterprises in response to environmental policies, such as for the reduction and treatment of saline water and other discharges by mines, industrial wastewater treatment in pulp, textile, metallurgical and chemical plants, and for measures to reduce discharges of toxic materials from chemical and petrochemical plants.
- Low cost measures to address long-term environmental priorities where prompt action can avoid the need to spend much larger sums in the future. Improved transport management, phasing out leaded gasoline and reducing vehicle emissions, formulating and applying practices for sustainable agriculture and tourism, applied research on the protection of threatened species and ecosystems, and the development of systems to collect, interpret and disseminate environmental data all fall into this category.

Regional and global concerns

The central element of a strategy to address regional or global problems of air and water pollution must be to build, as far as possible, on the overlap between the local and the transboundary impacts of measures to reduce emissions.

Transboundary pollution

AIR. Market reforms and targeted policies or investments to meet domestic environmental goals will lead to large reductions in emissions of regional and global air pollutants. In considering further reductions in the CEE countries to meet regional and global concerns, donors may wish to contribute towards measures to accelerate the necessary reductions. There might be scope for mutually beneficial agreements which could result in larger reductions in environmental damage than could be obtained by spending the same resources domestically.

WATER. Maximizing the joint domestic and transboundary benefit of improving water quality implies that

resources need to be directed to reducing the flows of nutrients and emissions of harmful substances from agricultural, domestic and industrial sources (including dumping sites for radioactive waste) to bring about the overall reduction of contaminants in coastal and estuarial locations. The Baltic Sea Joint Comprehensive Environmental Action Programme of the Helsinki Commission to a large extent reflects this philosophy. (From a domestic perspective, wastewater investments should focus on upstream areas.)

Global issues

CEE countries have committed themselves to addressing acidification, global warming, the depletion of the ozone layer and other regional and global environmental problems in the context of the relevant conventions, protocols and other forms of international agreements. While action to meet these commitments will continue well beyond the horizon of the Environmental Action Programme, as part of the EAP's policy reform and institutional and investment programs, CEE countries may need to take selected measures which go beyond those they would take as part of economic transformation.

With regard to the phaseout of Ozone Depleting Substances (ODS), they should, for example, focus on the aerosol and flexible foam sectors where ODS use can be eliminated at low cost, and prepare national recovery/reclamation/recycling strategies. They should review national legislation and strengthen institutional and technical capacity and measures in light of, for example, the Convention on Biological Diversity and the Basel Convention.

Institutional prerequisites to support policies and investments

Experience in Western countries shows that successful environmental policy requires the explicit commitment of the whole government, as well as the cooperation of the independent sectors, and an open approach to setting priorities and making choices. The enthusiasm and expertise of non-governmental organizations should be mobilized to contribute to the successful implementation of environmental programs, particularly through close monitoring of their implementation.

The greatest contribution to improved environmental management is likely to come from strengthening local and regional institutions within countries—in particular, improving their capacity for identifying priorities, developing policy, ensuring environmental compliance, and also for operating financial systems. National environmental authorities should place more emphasis on policy coordination and create task-oriented teams to work on priority issues. Substantial savings are possible by making environmental decisions at the level of river basins or air sheds, but this requires institutions that integrate the different local and sectoral interests.

Studies for project preparation and industrial reviews need to be re-thought. They must focus on those areas where scarce investment resources can provide the greatest benefits rather than offering pre-packaged recommendations based on conventional Western technologies. In particular, far more effort should go into *project identification*, rather than project preparation. Substantial local participation is essential both to formulate advice that can be implemented and to improve local capacity to achieve better environmental performance from existing facilities. These changes in approach will require much more careful attention to the terms of reference for studies to ensure that the resulting proposals meet clear objectives and address the financial and institutional constraints.

Implementation

The Action Programme establishes a partnership between Eastern and Western countries. While the responsibility for projects, policies and institutional improvements lies with CEE countries, Western governments and international institutions would provide technical assistance to support the policy and institutional reforms, and contribute toward the implementation of priority projects. The various partners must re-examine their policies and programs in light of the Action Programme. Governments—not just environment ministries—should actively support this process. Inter-ministerial task forces may be useful instruments for this purpose.

One of the principal challenges in implementing the EAP is to find the best ways to channel financial resources to, and to implement the smaller-scale activities that can be carried out in the short term, and to identify viable larger projects. There are three elements to this approach.

1. *A process for identifying priority actions which links the threats from the exposure of populations or ecosystems to pollutants with alternative mitigation strategies and their costs.* National environmental action programs will need to identify the problems, their impacts, and alternative strategies leading to policy, institutional and expenditure actions at specific locations where there is a clear case for urgent environmental expenditures. The necessary calculations and analyses are not easy, and there are generally no simple relationships between sources of environmental pollution and environmental damage. However, in deciding on particular environmental actions, implicit assumptions are made in any case.
2. *Mechanisms to ensure that actions requiring modest expenditures which can bring substantial environmental improvements are speedily identified and implemented.* Some CEE countries have already launched programs of rapid environmental reviews, or audits, in different sectors. Such reviews are essential steps to develop recommendations for low cost environmental improvements. The small expenditures could be financed through national and/or local pollution abatement funds. External agencies could contribute to such a fund which would generally make financing available in the form of loans at normal real rates of interest. In addition, grants could be made available separately where "win-win"

investments are not sufficient to remedy the most urgent environmental problems. Again, some countries are already pursuing these ideas in practice.

3. *A framework for financing larger investments (typically through loans) which gives particular emphasis to "win-win" opportunities but which can be combined with public funding to meet high priority environmental goals that cannot be justified on economic grounds alone.* Larger investments of course require the full application of the project-based approach with feasibility studies and other preparatory expenditures. However, good feasibility studies should address alternative strategies and the phasing of investments.

Project Preparation Framework

Discussions have been initiated to reinforce the partnership under the Action Programme through a "Project Preparation Framework." This would provide the necessary initial funding to help identify high priority environmental investments in accordance with the Action Programme and to advance such proposals rapidly to the stage where they can be financed either by CEE countries themselves, or through bilateral or multilateral channels.

ECONOMIC INDICATORS FOR COUNTRIES OF CENTRAL AND EASTERN EUROPE, 1991-94

	GDP [1]				*Industrial production* [1]				*Agricultural production* [1]				*Unemployment rate (%)*				*Gross foreign debt (billion US$)*		
	91	92	93	94	91	92	93	94	91	92	93	94	91	92	93	94	91	92	93
Albania	-27.1	-9.7	11.0	..	-40.0	-60.0	-10.0	..	..	18.0	14.4	..	..	..	18.0	14 [7]	0.6	0.7	0.83
Bulgaria	-16.7	-5.7	-4.2	..	-27.5	-7.7	-9.0	-4.8 [4]	-13.2	-9.0	..	..	10.2	15.6	15.9	13.4 [9]	11.4	14.2	14.7
Czech Republic	-16.0	-7.0	0.0	3.5 [2]	-25.0	-11.0	-5.0	-4.6 [5]	-14.0	-12.0	-1.0	..	4.0	3.0	3.0	3.0 [9]	9.3	9.5	8.7
Estonia	-11.8	-23.0	-7.8	..	-9.5	-38.7	-28.4	..	-20.8	-21.3	..	..	..	1.5	1.7	2.1 [9]	0.04	0.07	0.09
Hungary	-11.9	-4.3	-2.3	..	-19.1	-9.8	4.0	7.8 [3]	-5.0	-23.0	-6.0	..	8.5	12.2	12.1	11.0 [9]	22.7	21.4	24.5
Latvia	3.5	-32.9	-12.0	..	0.0	-35.1	-39.6	..	-3.6	-13.0	-2.8	..	..	2.3	5.3	32.4 [5]	0.08	0.02	..
Lithuania	-12.8	37.7	-17.0	..	-1.3	-51.6	-46.0	..	-8.0	-24.0	-8.0	..	..	1.0	1.6	3.2 [9]	0.1	0.13	..
Poland	-7.6	1.5	3.8	..	-14.0	4.2	7.9	9.9 [7]	-0.9	-11.0	1.5	..	11.8	13.6	16.1	16.6 [9]	48.4	49.9	47
Romania	-13.0	-13.6	1.0	..	-18.7	-21.8	1.3	-1.8 [4]	-5.0	-12.1	14.0	..	2.9	8.4	10.2	10.8 [9]	1.9	3.4	4.4
Russia	-9.0	-19.0	-12.0	-17.0 [5]	-8.0	-18.8	-16.0	-25.8 [5]	4.7	-9.0	-5.0	-4.5 [7]	0.1	1.0	1.4	1.6 [6]	67	77.7	83.5
Slovak Republic	-16.0	-6.0	-4.0	3.6 [2]	-25.0	-13.0	-14.0	3.0 [6]	-14.0	-12.0	-7.0	..	12.0	1.0	14.0	13.9 [8]	9.3	9.5	3,4
Slovenia	-9.3	-6.5	1.0	..	-12.4	-13.2	-2.8	5.8 [4]	-1.0	-17.0	..	..	10.1	13.3	15.4	14.6 [7]	1.8	1.8	1.9
Ukraine	-10.0	-17.0	-14.0	-34.0 [2]	-13.0	-15.0	-16.0	-38.0 [4]	-4.0	-9.0	-1.0	-5.0 [2]	0.0	0.0	0.3	0.3 [2]	..	10	..

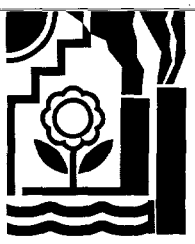
.. No statistics available

1/ Percentage change over the same period of the previous year.

Latest period for which data are available:

2/ January-March
3/ January-April
4/ January-May
5/ January-June
6/ Feb
7/ April
8/ May
9/ June

Sources: European Commission, Directorate-General for Economic and Financial Affairs. 1994. Economic Trends, Supplement A (8/9).



Chapter One

Introduction: Why an Environmental Action Programme?

Chapter Contents

The resources available for environmental improvement in the countries of Central and Eastern Europe (CEE) will be severely constrained over the next 5–10 years. The costs of meeting some environmental objectives will, however, be very high. The Environmental Action Programme provides a framework for setting national environmental priorities within each country in Central and Eastern Europe and for cooperation between Eastern and Western countries.

The main constraints on implementation arise from a general lack of financial and above all institutional capacity rather than from the nature of particular environmental problems or potential solutions. So the most urgent problems will not be solved unless a clear goal is established at the outset and the most efficient way to reach that goal is identified.

Objectives

The Environmental Action Programme (EAP) builds on the efforts already being made by countries in Central and Eastern Europe—in some cases together with donors and financing institutions—to address environmental problems. The goal is:

- *first*, to make it easier to reach a consensus within and between countries of East and West on the most urgent environmental problems; and
- *second*, to endorse a mix of policies, investments, and institutional reforms in which all countries and institutions involved can play an appropriate part.

By establishing a consensus within and between countries of East and West, the EAP provides a basis for an evolving partnership to tackle the most urgent environmental problems in the CEE region. CEE countries would undertake essential policy and institutional reforms, and western governments and international institutions would make a commitment to provide technical and other assistance to support these reforms, and contribute toward implementation of projects mutually agreed to be of high priority. This requires that all partners re-examine their policies and programs in light of the EAP. Working in this way, limited resources can be used most efficiently, and a greater degree of environmental protection secured than otherwise would be the case.

Many CEE countries are actively developing and implementing environmental programs and policies, albeit under severe constraints. The EAP is a *framework document* that complements these activities by proposing ways to establish priorities. As such, it is intended to provide the impetus for different countries to adapt its ideas to their own circumstances and to prepare their own action programs. The EAP offers ways to identify immediate actions, and a broad strategy to build environmental concerns into the economic transformation of the countries of Central and Eastern Europe. Rather than prescribe what must be done, the EAP offers decision makers ways of looking at the problems and applying their own judgment. It is meant to be a living document: as our understanding of the environmental problems improves and changes, the EAP will be reviewed and updated.

The High Costs of Environmental Cleanup

The recent political changes and the transition to a market economy involve much economic and social hardship for the countries of Central and Eastern Europe. Concern for the environment has slipped down on the agenda. Even now, however, CEE countries continue to spend between 0.5% and 1% of GDP on environmental policies. Some have passed strict new laws and regulations which will commit them to continued heavy investment. Because of the amounts of money at stake, environmental expenditures ought to be scrutinized in the course of reviews of public investment by those making budgetary decisions. In Poland, for example, the difference in annual costs between *alternative approaches* for reaching air-quality targets which have already been adopted is more than twice the projected average annual spending in the power sector over the next 20 years.[1]

The costs of meeting Western environmental standards are high. For example, the total costs in this regard for the new German *Länder* have been estimated to range between DM83 billion and DM321 billion, of which some DM53-150 billion would be required for building municipal wastewater treatment plants meeting West German standards. To provide wastewater treatment meeting EU standards to the 300 major municipalities in Poland, the Czech and Slovak Republics, Hungary and Bulgaria would cost at least US$50 billion. The cost of applying the 1997 Polish emission standards (which are similar to the relevant current EU standards) to existing thermal power plants in Poland has been estimated to range from US$3 to US$10 billion, depending on the age of the plants selected. Scaling up this figure implies a cost of at least US$30–35 billion for all of the CEE countries.

In addition, many governments in Central and Eastern Europe have made international commitments under global conventions, treaties and other forms of agreements which have substantial financial implications, including the *Montreal Protocol on Substances that Deplete the Ozone Layer* (1987), the *Basel Convention on the Control of Transboundary Movements of Hazardous Waste* (1988), and the 1979 *Geneva Convention on Long-range Transboundary Air Pollution* (LRTAP), with its related protocols on emission reductions for sulfur dioxide, nitrogen oxides and volatile organic compounds. Other agreements to reduce land-based pollution of the marine environment may also require substantial commitments over the coming 20–30 years, such as those under the 1974 and 1992 *Helsinki Conventions on the Protection of the Marine Environment of the Baltic Sea Area* and the Baltic Sea Joint Comprehensive Environmental Action Programme, implemented within the Helsinki Commission (HELCOM), the 1976 *Barcelona Convention for the Protection of the Mediterranean Sea against Pollution*, and the 1992 *Bucharest Convention on the Protection of the Black Sea against Pollution* (see Chapter VI).

International Assistance

Initial information for Poland and Hungary suggest that international assistance in 1991 amounted to slightly more than 5% of all environmental expenditures. This low figure partly reflects low disbursement levels, which in turn is an indication of the weak capacity of institutions to absorb international funding.[2] In any case, CEE countries are meeting well over 90% of the costs of environmental expenditures out of their own resources.

The Action Programme recognizes that the bulk of resources for environmental expenditures in Central and Eastern Europe has to be found in those countries themselves. At the same time, the EAP is intended to provide a consistent framework so that donors can provide urgently needed help with specific problems. Special assistance or burden-sharing arrangements also may be appropriate when dealing with transboundary environmental problems. The establishment of innovative financing mechanisms in CEE countries as well as between CEE and donor countries merits special examination.

Box 1.1 Environmental Investment Expenditures in Poland

Expenditures have grown substantially in Poland, corresponding to the rapid increase in pollution charges and non-compliance fees up to 1992. In 1991, US$840 million was spent on the environment from public and private sources, corresponding to 1% of GDP:

State budget (grants)	5%
National Fund (grants+soft loans)	15%
Regional Environmental funds (grants)	25%
Enterprises (polluters' own resources+loans)	30%
Municipalities (budgets+commercial loans)	20%
International Assistance (grants+loans)	5%

Of the total environmental investment expenditures, 45% was spent on water quality, 40% on air quality, and 15% on solid waste management.

The Need to Set Priorities

In view of their significant environmental problems, the countries of Central and Eastern Europe are faced with the need to make big environmental expenditures at the very time when they are suffering economic hardship that is worse than anything the Western market economies have experienced since World War II. They cannot afford to waste their scarce resources. Priority setting implies that there are measures which should *not* be taken at this time, just as there are actions which should be taken urgently. This report offers criteria for choosing priorities, and draws attention to the need to think carefully about problems and solutions. Experience in the wealthiest OECD countries suggests that some "solutions" do not address the real problems. What should be the measure of success: the amount of investment in air or water pollution control, or a cleaner environment? Some of the recommendations in this report therefore apply equally to many Western countries.

Of course, many investment decisions are not made purely on the basis of environmental factors. An environ-

mental investment is often said to be justified by the availability of local or foreign exchange, by the apparent willingness of local institutions to undertake it, by its demonstration value, or various other elements that may contribute to its "implementability" or "bankability." But most of these justifications have nothing to do with the goal, which is to reduce exposure of humans and ecosystems to environmental pollution and to enhance the productivity of natural resources.[3] Decision makers should therefore at least be offered a sound analysis which presents them with consistent *options* to achieve the principal *objectives*. For example, there is little use in carrying out studies which recommend the strictest environmental standards when the funds are not available to carry out the necessary investments.

The key to successful project development is to focus first of all on *describing the important problems to be solved,* and *then identifying creative options and approaches* to addressing those problems in the most effective manner with the *available resources.* This will involve a mixture of different instruments, including not only investments but also institutional development, economic and environmental policies. Similarly, national environmental action plans should set realistic and monitorable environmental quality targets, and propose a range of options covering policy, institutional and expenditure measures to achieve those targets over a specific period.

To succeed, priority setting and the development of environmental action programs in CEE countries must involve the public. Non-Governmental Organizations (NGOs) can help to initiate wider discussion of the EAP, for example, through roundtables involving government, community and business organizations. In addition, the promotion of public participation would help to facilitate many of the EAP's objectives.

Why a Regional Approach?

Each country in Central and Eastern Europe has its own specific environmental problems, which reflect historical patterns of development and of the use and misuse of natural resources. However, all share the legacy of former regimes. These diverse countries face a number of common problems which have important environmental implications:

- Large increases in energy prices, especially for solid fuels and for households. These will be accompanied by much higher prices for other natural resources including mineral ores and quarry products;
- The gradual imposition of "hard" budget constraints on enterprises, together with a shift in their objectives from meeting production targets to making profits and improving productivity;
- The progressive replacement of out-dated or outworn capital equipment, mostly embodying 1930s or 1950s technologies, by more modern capital typically found in OECD countries;
- Large changes in the structure of economic activity, involving a move away from heavy industry towards services and certain industrial sectors—e.g. food processing, paper and paper products, chemicals and automobiles;
- A shortage of management capacity, although labor is well-educated and in some cases exceptionally skilled.

In the general character of their environmental problems and the direction in which they are likely to change, the similarities between the countries of Central and Eastern Europe are stronger than the differences. So, the regional approach adopted by the EAP allows the lessons of experience to be shared in different countries and sectors.

Box 1.2 Follow-up of the Lucerne Ministerial Conference

At the Ministerial Conference "Environment for Europe", in Lucerne, Switzerland, a Task Force was established with the participation of Eastern (including FSU) and Western governments and international organizations and financial institutions, to facilitate the implementation of the EAP, and to provide for effective exchange of experience among CEE countries. The Task Force is co-chaired by a Central and Eastern European country on a rotating basis, together with the Commission of the European Union; OECD serves as the secretariat, with the active support of the World Bank and the EBRD. Mechanisms for actively involving the informal sector (NGOs, the business and academic communities) are being identified. NGOs have already established various working groups and held meetings with a view towards assisting in the implementation of the EAP.

At its first meeting on 27-28 September 1993 the Task Force adopted terms of reference and a work program, and agreed on a schedule for translating the EAP into detailed national action plans. The Work Program consists of four core activities:

(i) channelling assistance to disseminate the EAP approach and enable all CEE countries to develop their own national Action Programmes;
(ii) running training programs to build up capacity to identify, prepare and manage priority environmental projects;
(iii) engaging the private sector to promote environmental improvements in enterprises; and
(iv) enhancing the management of priority conservation areas.

The Task Force, which will concentrate above all on institutional and policy issues, will liaise with the Project Preparation Committee which was also established at the Lucerne Ministerial Conference to help with project preparation and investment. Its objectives are to strengthen the linkage between donors, international financial institutions and Central and Eastern European countries, and to promote the mobilization of resources for the region. Finally, the Ministerial Conference agreed that all the partners concerned should undertake to review the implementation of the EAP as appropriate, inter alia through environmental performance reviews. Progress is to be reviewed at the next ministerial conference which is scheduled toward the end of 1995 in Sofiya, Bulgaria.

Notes

1. To achieve the improvements in air pollution emissions currently mandated by Polish law, and to match the equivalent of EU standards for vehicle emissions over the next 25 years, will cost an estimated US$1.6 billion per year. A study carried out for the EAP has calculated that an approach involving emissions taxes could reduce the costs of achieving the same target to US$0.7 billion a year. The potential *savings for air pollution control alone is US$900 million per year.*

2. At the same time, international assistance to Poland and Hungary has probably been higher (certainly on a per capita basis) than to most other CEE countries.

3. Environmental improvement is one of three important *objectives* of economic and social development. The other two objectives, which should be pursued simultaneously wherever possible, are *economic efficiency* (reduced economic costs) and *equity* (fair distribution). Where tradeoffs among these objectives are necessary, they should be clearly spelled out. Financial considerations (e.g., cost recovery) and administrative feasibility are important in deciding *how* to achieve the objectives in a sustainable manner, not *whether* to pursue them in the first place.

Chapter Two

How to Set Priorities

Chapter Contents

Setting priorities basically means ensuring that the policies followed first will achieve the greatest gain relative to given objectives and available resources. That involves choices. The first concern in the region is the damaging effects of pollution on human health—as it was in the West before the worst environmental health threats had been addressed. Human health in various parts of the CEE seems to have been affected by lead in air and soil, by airborne dust, by sulfur dioxide and other gases, especially when combined with dust, by nitrates in water and by contaminants in food and water. Major expenditures to ensure the proper disposal of waste, especially nuclear waste, and the safety of nuclear plants, are likely to be worries for the future. For now, good operation and maintenance are paramount requirements.

Apart from human health, environmental policy may also need to take account of economic losses caused by damage or destruction of physical capital and natural resources, and of threats to coasts, lakes, forests and mountain habitats. It should give priority to measures that cost little, but are likely to have a big impact on problems which will get worse as time goes by and which may be easiest to solve if action is taken early.

To set priorities, policymakers need to ask the following questions:

- What do people care about? Are they, for instance, more concerned about dirty rivers, or the conservation of wildlife, or the environment that will pass to future generations? The answers involve value judgments;
- In light of these value judgments, what are the most serious environmental problems? This question requires an estimate of the costs of environmental damage (or the benefits of environmental protection and remediation) relative to the gains that policymakers hope to achieve; and
- What are the most efficient ways to achieve different environmental goals?

Both the costs of environmental damage and the cost-effectiveness of the solutions will vary considerably over time, and so will environmental priorities.

This chapter first describes some ways to assess the costs of environmental damage. It then uses these methods to give an initial overview of the most serious types of problems. The chapter then looks in detail at human health as a particularly significant short-term worry, and concludes by making recommendations on the most efficient ways to achieve environmental objectives.

The central message is the need to balance the benefits of environmental policy against its costs. That will not be easy: people differ in the value judgments they make about various kinds of environmental damage. But benefit-cost analysis in the broadest sense offers a way to think systematically about choices. When money and management capacity are scarce, as they are in Central and Eastern Europe, that is particularly important.

The costs of environmental damage

The economic and social costs of environmental damage are usually divided into three broad categories:

• Health costs. Environmental pollution may lead to sickness and premature death. Human health may be harmed by direct exposure to pollution, or indirectly through the impact of pollution on the physical environment. To assess the health consequences of environmental damage in Central and Eastern Europe means relying mainly upon epidemiological studies from OECD countries since there are relatively few local investigations which control adequately for the contributory influences of factors such as smoking and diet.

• Productivity costs. Environmental degradation reduces the productivity of natural resources and physical capital. It may disrupt the services that nature provides, such as the natural cleansing of water, or the yield from fisheries. Or pollution may force people to spend more on cleaning and maintaining houses and other buildings.

• Loss of environmental quality, or amenity costs. A clear view, a pristine lake, a mature forest, and clean and quiet neighborhoods all add to the quality of life. People are willing to forgo expenditure on other goods and services in order to protect endangered species and ecosystems, and enjoy the benefits of better environmental quality either for themselves or for future generations. This aspect of environmental quality is hardest to quantify, but its loss particularly conflicts with the principle of sustainable development, in that current generations do not "meet their needs without compromising the ability of future generations to meet their own needs."[1]

While figures for the total cost of environmental damage are often quoted for various Central and Eastern European countries (ranging from 2-10% of GDP), these are rarely based on a systematic assessment. Estimates which have been produced for Poland suggest that environmental damage may have cost 3-4% of GDP in the mid-1980s, 2-3 times as much as comparable costs in Western European countries. The most important single component is thought to be the damage to human health caused by air pollution, especially exposure to high levels of particulates (soot and smoke in the air). The next most important elements are productivity costs imposed by high levels of water salinity (caused by discharges from coal mines) and BOD in the country's principal rivers.[3] Finally, poor air quality in urban areas also imposes amenity costs.

Similar studies have not been carried out for other Central and Eastern European countries. However, as health damage is the primary cost of environmental pollution even in some of the wealthiest OECD countries, it is probably the largest component of environmental damage in Central and Eastern Europe as well. Health is also an important concern in public perception: According to a recent Gallup survey, 89% of Russians (80% of Poles) asked indicated they are concerned about the pollution effects on personal health.

The costs of reduced productivity of natural resources and physical assets are much more unevenly distributed. Discharges of saline water from mines are a problem in Poland and a small part of the Czech Republic. In the mining areas of Ukraine, the dumping of mine and washery waste and acid mine drainage are serious problems. Exposure to particulates and acid pollutants may damage materials as well as human health. Soil contamination, salinization and acidification all cause considerable loss of agricultural productivity and damage forests and lakes in some places.

Little is known about the amenity value of a better environment in Central and Eastern Europe. Economic difficulties seem to have lessened the importance people give to environmental problems. Amenity losses may seem more important once the most severe forms of pollution are dealt with, but they should not be an immediate priority for environmental policies, except in the few instances where there are risks of irreversible sacrifices now. When air and water pollution is cleaned up, that will generally help to maintain healthy and diverse natural ecosystems and landscapes.

Environmental damage and human health

Most governments will give the highest priority to dealing with those aspects of environmental damage which affect human health. Indeed, governments involved in the preparation of the Environmental Action Programme for Central and Eastern Europe have explicitly requested that special emphasis be given to human health concerns. In the past, the links between information on human health and environmental action have been relatively weak in most CEE countries. So this section looks in more detail at the links between pollution and health.

Since the mid-1960s, life expectancy in Western Europe, North America and Japan has continued to rise, while in Central and Eastern Europe, life expectancy has remained static or has even declined. This gap (of approximately 5 years) is primarily attributable to relative increases in mortality from chronic diseases in mid-life. However, the reasons for this relative increase are not yet clear. The explanation must involve some combination of factors in the socioeconomic and physical environments, behavior patterns and social habits such as smoking and diet, and shortcomings in health care.

The relative decline in life expectancy in CEE has taken place in both heavily polluted and relatively unpolluted parts of the region. That suggests the influence of environmental factors on health is not paramount. On the other hand, it may be important. Life expectancies in rural areas in Poland have surpassed those in urban areas in recent years, a highly unusual demographic trend which may be associated with the fact that environmental pollution is concentrated in urban areas. In the Czech Republic, there is good evidence that dust and sulfur dioxide pollution increase the risk of infant mortality. Moreover, declines in life expectancy in the Czech Republic are correlated with the proportion of people living in regions affected by heavy air pollution. Recent evidence from studies done in the West will allow us to estimate the impact of respirable dust on overall mortality in Central and Eastern Europe. Preliminary estimates show that the effect is likely to be substantial.

The Action Programme has looked at exposures that are not related to occupational health problems.[2] Data

from ten CEE countries have been used to tentatively identify locations where people are exposed to specific health risks from particular kinds of pollution. The specific locations are described in Annex 1.

The most common health problems are the result of exposures to a fairly narrow range of pollutants. The most important are:

- Lead in air and soil, which affects especially children whose mental development may be retarded (sources include lead and zinc smelters, and vehicle exhausts);
- airborne dust, which may cause acute and chronic respiratory conditions (sources include especially household coal burners, power and heat plants, and metallurgical industries); and
- Sulfur dioxide and other gases, especially in combination with dust (sources include power and industrial plants as well as households using high-sulfur coal or high-sulfur fuel-oil).

Maps 1-6 give an estimate of the areas where exposure to these pollutants occurs persistently.

Because of synergistic effects between airborne particulates and gases, the places where environmental health problems are caused by airborne pollutants need to be carefully studied to discover the relative importance of gaseous exposures and of dust. There is a large and growing body of scientific evidence that fine particle air pollution causes serious health damage and significantly raises the risk of death—even in the most advanced OECD countries. The most recent study, which followed 8,111 adults for 14-16 years and which adjusted for age, sex, smoking, education level, and occupational health risks, concludes that mortality is most strongly associated with air pollution with fine particulates.[4]

Apart from inhaling pollutants, people also eat and drink them. Pollutants in food and water have some effect on health, but are on average less prevalent and/or less clearly related to ill health than lead, dust and airborne gases. Food in several parts of Central and Eastern Europe is a source of exposure to heavy metals, pesticides, polycyclic aromatic hydrocarbons, and chlorinated organics such as PCBs. Many of these substances have well-documented toxic properties and yet the effects on human health of ingesting largely unknown doses is uncertain. Other pollutants are ingested in water contaminated with nitrates or with a variety of other substances. Arsenic, viruses/bacteria, pesticides, radionuclides, and chlorinated organics have all been found in drinking water in various places in Central and Eastern Europe. Nitrate pollution of water is widespread in rural areas throughout the region, and can be particularly harmful to infants (see Map 7).

The main pollution problems

Several parts of Central and Eastern Europe suffer from particularly serious environmental damage. However, in many respects, Central and Eastern Europe is not so unusual: air (and to a lesser extent water) pollution is largely confined to cities where there are concentrations of industries, power plants, homes and vehicles. At the same time, Poland, Ukraine, and especially Russia, contain some of the world's most extensive areas of virtually untouched nature, which are highly sensitive to pollution.

From a historical perspective, it is worth keeping in mind that some of today's "hot spots" in Central and Eastern Europe have had environmental problems since the early part of the century. Central planning under the former regimes only perpetuated and exacerbated old patterns of pollution, preventing the changes that occurred in the market economies. The implication is that the experience in the market economies may be quite useful in helping CEE countries to identify which steps to take and which to avoid. It should also be clear that it will take time—even under the best of circumstances—to remedy the problems of the past.

Air quality

Air pollution is potentially the most serious short-to-medium term environmental problem for human health. It is also one that has received relatively little emphasis in the environmental expenditure programs of Central and Eastern European countries. Polluted air is more difficult to avoid than polluted water. Its pervasive effects damage human health, buildings and nature. Treating air pollution should be the top priority for environmental policy.

The most serious effects of air pollution are on human health. Exposure to pollutants will vary greatly from one place to another, depending on a number of factors, such as geography and weather conditions. Maps 1 and 3 show the places where local exposures to two of the principal air pollutants—particulate matter and sulfur dioxide—exceed annual average ambient standards of the European Union.

Occasional peaks in exposure may do more harm than the average level over the year. In Katowice, Poland, for example, maximum 24-hour ambient concentrations of black smoke in the winter heating season are more than six times the EU standards. A London smog in 1952 (which reportedly cost the lives of almost 4,000 people) exceeded the present EU standard more than ten times; and current EU standards are frequently exceeded in many Western European cities during peak smog periods, which has led to the enactment of special smog-alert and smog-control measures. One implication may be that, in the short run, CEE cities need not just general emission controls, but better systems for dealing with air pollution emergencies.

Air pollution also leads to acid rain, which is caused primarily by SO_2 and NO_x emissions from power plants and motor vehicles, and damages forests and lakes. The impact of acid rain, however, is not straightforward, as it depends on climatic, biological and geological conditions which determine patterns of rainfall and the capacity of the soil to buffer acidity. This may have important implications in setting priorities for cleanup of transboundary air pollution. Clearly, in some areas of Europe, acid rain has done serious harm to forests and ecosystems, and rapid action may be warranted. This is particularly true where soils are less capable of buffering acid depositions.

Box 2.1 Developing Country-Specific Priorities

Although all of the Central and Eastern European countries addressed in this Environmental Action Programme face similar types of problems inherited from the past, the immediate priorities for some countries will be very different than for others. This reinforces the need for countries to develop their own environmental action programs that reflect their particular circumstances. These country-specific EAPs should be flexible and regularly up-dated to match the changing economic and environmental conditions.

Albania, for example, is much less industrialized than other countries in the region, and while there are localized air quality problems near industrial facilities, as a whole the country does not have as serious air pollution problems as its neighbors. Albania's most serious environmental problems are concentrated in its rural areas and include (i) deforestation because of uncontrolled cutting of trees for fuelwood and building materials; (ii) soil degradation due to poorly maintained hillside terraces and overgrazing by livestock; and (iii) contamination of soil and groundwater supplies used for drinking and irrigation. Over 60 percent of Albania's population resides in rural areas and about 50 percent of the country's gross national product is derived from agriculture and forestry, so these problems affect large numbers of people and have significant economic impacts. The most serious problems affecting cities are unsafe and unreliable drinking water supplies, which cause health problems and productivity losses for urban residents.

In recent years, air pollution in many areas in CEE has been decreasing. In the former Soviet Union, air pollution in the principal cities is reported to have declined by 10% during the 1980s, and the nationwide reduction in emissions in Poland has been 20–30%, and 15–45% in Bulgaria over the past four years. In certain urban areas, pollution levels dropped even more.

It is, of course, difficult to identify how far these reductions result from improved pollution controls and/or long-term economic restructuring, and how far the cause

Box 2.2 Portraits of Different Kinds of "Hot Spots"

Regional Hot Spot: The mining districts of Northern Bohemia

- Mortality rates from respiratory causes among 1-12 month old newborns in the areas of highest ambient dust and sulfur dioxide levels are 5–8 times higher than in places where air quality meets standards.
- Higher rates of low birth weight and congenital anomalies among newborns.
- Allergies and respiratory diseases are more prevalent among school children than in the rest of the Czech Republic.
- Children temporarily removed from the area to attend "nature school" in an unpolluted area show immediate evidence of improved red blood cell count which reverses when they return home.
- Higher mortality from lung cancer and other causes among both men and women than in the Czech Republic as a whole.

A Town with a limited number of large point sources of pollution: Copsa Mica, Romania

Copsa Mica is home to several poorly maintained industrial facilities, among them two lead smelters. Health problems of particular interest in the community include respiratory problems from exposure to dusts and gases and neurobehavioral problems due to exposure to lead.

Dust and Gases. One study examining pulmonary function in 371 Copsa Mica children aged 7-11 showed that of the exposed children 30% had reduced lung function measured in terms of "peak expiratory flow" and 18% had reduced lung function in terms of "forced expiratory capacity", compared with 10% of the control group.

Lead. Psychological testing was carried out on the same sample, as well as on a group of 12 year-old children. This was done because high lead exposures affect children's neuro-behavioral responses, including IQ. Approximately 30% of children are expected to test "weak or very weak," which means below the first standard deviation of the "normal" distribution. Instead, much higher percentages tested weak or very weak on the tests: 73% on an IQ test; 58% on a concentration test; 52% on a learning test; and 60% on a memory test.

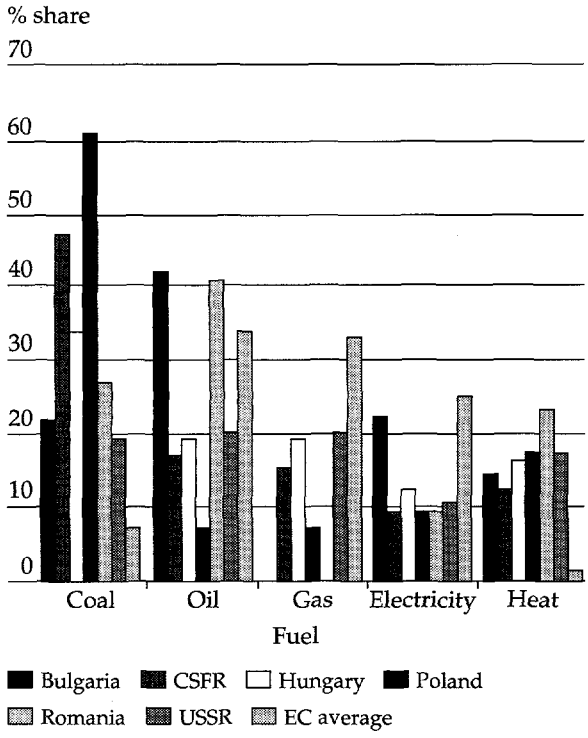
"Bad Town Planning": Dimitrovgrad, Bulgaria

In Dimitrovgrad, thick, acrid smoke containing hydrogen fluoride and hydrogen sulfide comes from a single chimney at a fertilizer plant. High-rise apartments and other settlements are located at the plant gate, their occupants exposed to high levels of these emissions. Studies have shown below normal physical development and lung function in children from Dimitrovgrad.

- 50% of children from Dimitrovgrad have below normal height, weight, and chest expansion for their age.
- Lung function is poor. By age 14, "forced expiratory volumes" averaged approximately 25% below a control group of children from an unpolluted town.
- An overall assessment was made of children's developmental status in Dimitrovgrad, compared to the control town. Whereas 72% of control children had normal development, in Dimitrovgrad only 18% of children were so classified.

Figure 2.1 Fuel Use for Households, Commerce and Services

(% shares in 1988)



is the temporary decline in production. The discussion in chapter III sheds more light on this question.

CAUSES OF AIR POLLUTION. A principle cause of urban air pollution in Central and Eastern Europe is the heavy reliance of households and small enterprises upon poor-quality coal. Smoke and soot from low chimneys (or "stacks") are especially harmful to health. In many towns and cities—especially in coal producing areas—more than half the population is exposed to high levels of particulate and gas emissions from thousands of small coal stoves used in homes for domestic heating, and in small- and medium size enterprises burning coal for space heating and process heat.

Local heating and home furnaces tend not to have any systems of pollution control, while large factories most often do, though only for particulates. In Katowice (Poland), for example, 46% of soot and dust emissions come from low stack emissions of high-ash coal. In the republics of the former Soviet Union, the availability of natural gas has helped to reduce air pollution from small stoves in the principal cities, though not in smaller towns in coal producing areas.

Central and Eastern Europe relies heavily on coal, which accounts for 75% of total primary energy supply in Poland and 24% in Hungary, compared with 19% in OECD Europe. Figures 2.1 and 2.2 (detailing patterns of fuel consumption by sector calculated in tons of oil-equivalent) show that households and the service sector rely far more on coal in the CEE than in the West—for example, 63% in Poland and 19% in the former USSR, compared with less than 5% in Western Germany and Spain.

Not only do the CEE countries use proportionately more coal than Western Europe; more of the coal that is burnt consists of poor quality brown coals and lignites. In an attempt to achieve greater self-sufficiency, the CEE countries developed reserves of brown coal and lignite during the 1960s and 1970s when the market economies were turning away from coal towards first oil and then gas. As a result, by 1989 brown coal and lignite represented more than 75% by weight of total solid fuel consumption for Bulgaria, the former CSFR, Hungary, Romania, and the territory of the former Yugoslavia, though the shares measured in terms of tons of oil-equivalent are, of course, much lower because of the low calorific value of the solid fuels concerned. Even for Poland and the former USSR—both countries with large reserves of hard coal—these shares were 32% and 28%, respectively. In contrast, the highest proportions of brown coal and lignite in total solid fuel consumption in Western Europe were 58% for West Germany and 45% for Spain, while for most countries the share was less than 10%.

The smoke from poor-quality coal, especially when burnt by households and other small users, is especially harmful to health. This point is demonstrated by the following figures, which compare the minimum damage

Figure 2.2 Fuel Use for Electricity

(% shares for public supply in 1988)

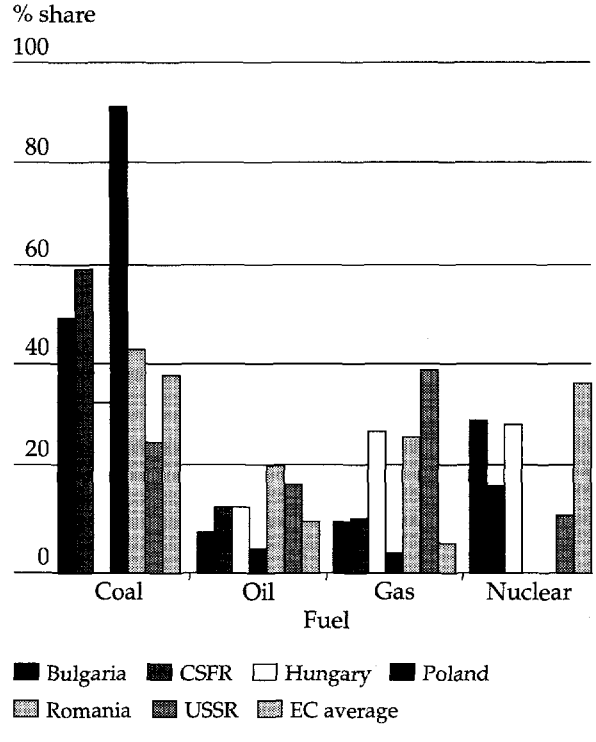


Table 2.1 **Minimum damage costs from pollution emitted by high and low stacks**

Source	*Sulfur Dioxide*	*Particulate Matter*	*Nitrogen Oxides*
	US$ per ton		
High stacks	265	60	180
Low stacks (households)	650	720	460

Source: Environmental Assessment of the Gas Development Plan for Poland (World Bank).

costs from pollution emitted by high and low chimney stacks in Poland (Table 2.1).[5]

A recent re-calculation of the numbers suggests that the damage costs from emissions of particulates may in fact be as much as three times the amounts indicated, i.e. US$180 and US$2160 per ton of particulate emissions from high stacks and households, respectively.

The example of West Germany shows that, given appropriate equipment and good maintenance—neither condition being satisfied in most CEE countries—it is possible to burn lignite and low grade coal in power stations and some large industrial plants without causing significant pollution problems. However, the only way of controlling pollution from burning coal in smaller boilers and open grates is to require the use of expensive smokeless fuels. This undermines the economic attractiveness of using coal, so that most households and small or medium sized enterprises will prefer to switch to electricity, gas or petroleum products if possible.

ENVIRONMENTAL IMPACT OF MOTORIZED TRANSPORT. With the exception of some large cities, such as Budapest, Kiev, Kharkov, Krasnodar, Moscow and St Petersburg, air pollution from transport is not yet a serious problem. Car ownership is still low compared with Western European countries: in CEE in 1990 the number of passenger cars per one thousand persons was on average only one-third that of Western Europe (Figure 2.3). Growth rates for passenger car fleets, however, are among the highest in the world, and demand for motorized transport is likely to increase as incomes rise and markets are liberalized (Figure 2.4). In addition, the proportion of freight carried by road (including multi-modal and container transport) in CEE is still much lower than in Western Europe and is likely to grow rapidly with the development of new export markets. Thus, as emissions from stationary sources are brought under control, and as vehicle ownership rises, mobile sources will contribute an increasingly important share of air pollution.

In Central and Eastern Europe, mobile sources (mainly road traffic) are responsible for about 30–60% of emissions of nitrogen oxides, between 40% and 90% of emissions of carbon monoxide, between 35% and 95% of lead emissions, less than 10% of particulate emissions, and less than 5% of sulfur dioxide emissions (vehicles also emit small quantities of a variety of toxins and carcinogens such as benzene and aldehydes). Those proportions are, of course, higher in cities which have little industry and which do not rely upon coal for domestic heating. In Budapest for example, transport sources contribute about 80% of carbon monoxide and lead levels, 60% of nitrogen oxides, 75% of hydrocarbons (HC) levels (the precursors to ground-level ozone), and 12% of sulfur dioxide levels. In most cities in the region however, the contribution of home heating, power generation and industry to air pollution still outweighs the contribution from traffic. Thus, while countries with reasonable air quality in most towns and cities should rightly give priority to addressing the pollution associated with urban traffic, this would not be appropriate for the majority of CEE countries where the main threat to health from poor air quality comes from emissions of particulates and sulfur dioxide from industry and home heating.

Water quality

As in Western Europe, many rivers in Central and Eastern Europe are seriously polluted downstream of principal urban areas, especially with organic waste (BOD), and probably heavy metals and micro-pollutants from the dis-

Figure 2.3 Number of Passenger Cars/ 1,000 Persons 1990

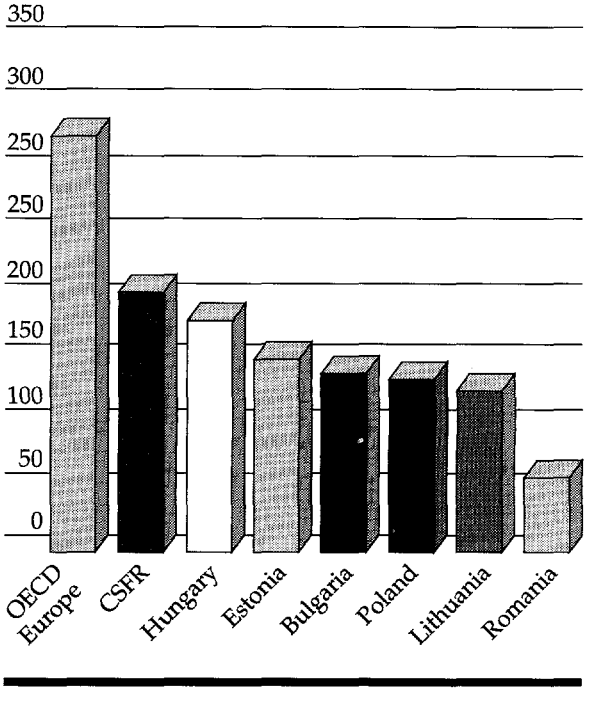
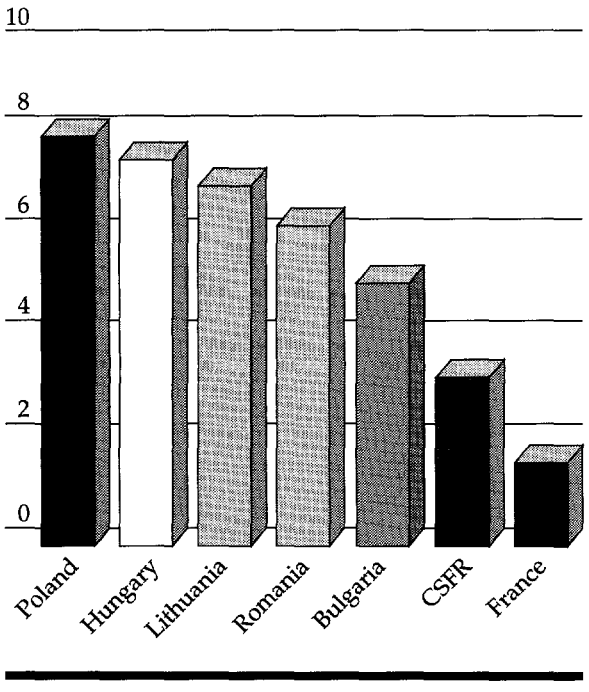


Figure 2.4 Average Annual Percentage Growth in Numbers of Cars/1,000 Persons: 1980-90



charge of industrial and municipal effluent which has been treated only partially or not at all. However, few of the rivers are biologically "dead" (except for small streams serving as "sewer canals") and, in general, they are probably cleaner than rivers passing the main industrial centers in Western Europe up to 20 or 30 years ago.

While attention has been focused on (large) point sources of water pollution such as industrial plants (including intensive livestock enterprises) or municipal facilities, it is important to remember that non-point sources—especially storm and agricultural runoff—account for most discharges of nutrients into rivers and lakes (60–70% of nitrogen, 40–50% of phosphorus). Estimates suggest that at least half the pollution in the rivers draining into the Baltic Sea comes from non-point sources.

MUNICIPAL WATER SUPPLY. In Central and Eastern Europe, water is used much more wastefully than in Western Europe (partly because it is underpriced) and in a number of countries it is frequently in short supply. This problem has often been solved by bringing in additional fresh water resources from increasingly greater distances and at growing cost.

Standards of treatment for drinking water also tend to be lower than in Western Europe. In general, municipal water supplies in most CEE countries have been treated adequately to prevent large outbreaks of infectious disease. This is mostly due to the adequate level of disinfection (chlorination), but it also reflects the temperate climate as well as the widespread reliance—especially in rural areas—on bottled water.[6] There is not yet enough evidence to be sure how far water in the CEE is polluted with carcinogenic substances (e.g., chlorinated pesticides). If the combination of inadequate supply and patchy treatment persists, increasing amounts of investment may be required to ensure the availability of acceptable drinking water.

MUNICIPAL WASTEWATER. In the Central European countries (such as Poland, the Czech and Slovak Republics, Hungary or Bulgaria), the current state of municipal water supply and sewage collection is generally adequate. This is much less the case in some of the republics of the Former Soviet Union. In the whole region, however, a substantial fraction of wastewater is discharged with little or no treatment. The principal types of water pollution in urban areas are organic wastes, nitrogen and phosphorus compounds, and suspended solids from municipal sewers, and to a lesser degree chemical wastes from industry.[7] To the extent that municipal wastewater treatment plants are available, they tend to be overloaded (more because of the wasteful use of water than because of the volume of actual wastes), improperly maintained and managed, or bypassed. All three Baltic countries have had to close beaches in recent years to prevent inadequate sewage treatment in adjacent settlements causing the spread of infectious diseases.

In the past, many large enterprises traditionally pretreated the wastewater they discharged into the municipal wastewater systems. Today, as firms are split up and privatized, the costs of industrial pre-treatment are felt to be high, and there is a risk that increasing amounts of industrial discharges (heavy metals, chemicals, PCBs, etc.) will flow directly into municipal sewers which are not equipped to handle such wastes. The metals content in sludge threatens sludge use for agriculture and other means of disposal. On the positive side, the increases in water pricing and the collapse or restructuring of industry often diminish the earlier overload of existing facilities. Also, a past tendency to build unnecessarily large treatment plants means that there is often adequate capacity once water consumption is reduced.

RURAL WATER SUPPLY AND WASTEWATER, AGRICULTURAL AND NON-POINT SOURCE POLLUTION. The problems in rural areas are quite different and potentially more dangerous to human health. First, less than 10% of the population is served by public water supplies, and there is little or no adequate wastewater disposal. Nitrate pollution, in particular, affects a large part of the rural population (about 35% of the total population of Poland, Czech and Slovak Republics, Hungary and Bulgaria). In Borsod County, Hungary, for example, nitrate levels are twenty times Western standards, and in about ten different regions in Bulgaria, an average of 35–45% of the population is exposed to elevated nitrate levels. One of the primary adverse health effects is methemoglobinemia[8] ("blue baby syndrome") which is life-threatening for infants. Recent preliminary evidence suggests that care-

less and unsatisfactory disposal of wastewater (e.g., septic tank runoff close to village wells) may be contributing significantly to the nitrate problem. The next most important sources of nitrate pollution are agro-industries such as pig farms and feed lots, and of course the runoff from fertilizers applied too heavily and frequently at the wrong time of year. In all of these cases, the solutions will depend critically on educating and training people, making them aware of the effects of their actions.

However, leaching of nitrate in agricultural soils is much more widespread in Western Europe, as shown in Map 7. In several countries in Western Europe, a high concentration of cattle and relatively high fertilizer use (on average, double the application rates in CEE) has led to accumulation of nutrients in soil and leaching to groundwater that exceeds EU drinking water standards. In CEE, by contrast, the rural population is more at risk because of the use of heavily contaminated shallow wells for drinking water.

SALINE WATER DISCHARGES AND MINE WASTES. The discharge of highly saline wastewater from a small number of coal mines is an important water quality problem which particularly affects Poland and to some extent the Czech Republic and Ukraine. Such water is highly corrosive if used for industrial or municipal purposes. Corrosion also damages infrastructure. In Poland, especially, much money has to be spent to treat saline water or to transport safer water. The productivity costs of these discharges probably account for the largest component of total losses due to water pollution in Poland (0.5–0.8% of GDP).

Tackling this problem has a high priority in Poland, but the answer is not obvious. Unfortunately, it is likely to be difficult or expensive to deal with discharges of saline water from the mines which are responsible. These are among the most productive mines in Poland, yielding high quality coal from deep but thick seams. Eliminating the discharges altogether would either mean closing certain mines or require substantial costs to re-inject water into the mines or to desalinize it. New mining techniques together with better management could reduce the volume of water discharged and its impact on the rivers affected, but these are only partial solutions. At present the mines have little incentive to find cheaper solutions, since they do not have to bear the costs of the damage caused by the discharges. This is a clear case where appropriate pollution charges can be implemented in order to provide an incentive to search for low cost solutions. Indeed, recently, an increase in pollution charges is reported to have led to an active search by a consortium of mines for investment finance to install desalination equipment. It is unclear, however, whether all the mines are paying the required pollution charges.

In Ukraine, the iron ore mines of Kryvyi Rih produce almost 50 million m^3/year of effluent, which is not only saline but also contaminated with heavy metals and radionuclides from nearby uranium deposits. Though the volume of water is much less than that discharged from coal mines, it is far more toxic in the short term, given the high concentration of heavy metals.

Solid and hazardous waste

Reliable information on the volumes and composition of municipal and hazardous wastes in Central and Eastern Europe is relatively sparse, especially since it is believed that a significant proportion of industrial hazardous wastes is disposed at municipal landfills. This unsafe co-disposal of hazardous and domestic wastes often occurs in unlined landfills with inadequate protection against seepage into groundwater. Toxic wastes stored at industrial sites may also contaminate nearby soil and groundwater. Finally, because of the growing shortage of available landfill capacity, inadequate enforcement procedures, and rising disposal costs, illegal dumping of both hazardous and non-hazardous wastes is increasing (implying potential additional health costs from groundwater pollution).

In some sites, mining wastes and ash from thermal power generation, sometimes with a high radioactive content, are badly disposed of. Former Soviet military installations are also believed to be potentially dangerous sources of toxic wastes, not only in the newly independent republics, but also in Poland, the Czech and Slovak Republics, and Hungary. Not surprisingly, little is known about wastes stored at former military sites, but their implications for environmental quality could be just as serious as that of conventional hazardous wastes.

Mining of coal, lignite, and metals such as chromium, copper, and iron contributes to environmental degradation in areas near mining operations. In addition, spoil heaps of tailings from mining operations (and slag from smelting) contaminate nearby soil. Uranium mining and milling releases radon and radon daughters which are potential

Box 2.3 Nitrates in Drinking Water in Romania

Elevated nitrate levels have been found in local water supplies in all but 2 of the 41 districts of Romania. According to a 1990 survey of water supplies in 2,474 places in the countryside, 7% were above 200 mg/l, 10% were between 100–200 mg/l, and a further 19% were between 45–100 mg/l. In 14 districts (Mehedinti, Dolj, Olt, Teleorman, Calarasi, Constanta and Bucuresti-SAT in the South; Tulcea, Braila, Galati, and Vaslui in the east; Botosani and Suceava in the northeast; and Satu Mare in the northwest), more than half of the water supplies exceed the standard of 45 mg/l. In these districts, up to 13% of the newborns a year were reported to develop methemoglobinemia.

Reporting of death from methemoglobinemia is patchy, so it is difficult to provide accurate numbers. Some insights into the impact may be gained from a special study of children in high nitrate areas in the Mehedinti/Dolj area. In 1989, 55% of the children in the study area had elevated methemoglobin in their blood. In 1991, there were 181 cases of methemoglobinemia, including 35 which were associated with diarrhea. In total, there were 9 deaths. If this death rate were to apply to other districts where methemoglobinemia is a common problem, it would make a significant contribution to infant mortality in those districts.

occupational hazards. It also releases process effluent and tailings which may contaminate groundwater.

Nuclear issues

Russia, Ukraine, Bulgaria, Lithuania, the Czech and Slovak Republics, and Hungary are all heavily dependent on nuclear power. However, nuclear plants in the region are of widely varying quality, in terms of their basic design, of the standard of construction and management, and (often most important of all) of their operation. Since the accident at Chernobyl in 1986, there has been widespread concern both in Western Europe and in the CEE countries about the safety of nuclear reactors. However, only Germany has permanently shut any reactors, at Griefswald. A few others have been temporarily closed, though not by choice, including two in Armenia as a result of earthquake damage.

The prospects for closing the most unsafe CEE reactors vary. Several countries are highly dependent on nuclear electricity, and cannot easily switch to alternative sources of fuel. The Bulgarian government has agreed to shut the four oldest reactors at its Kozloduy plant once alternative sources of electricity have been developed. The speed with which CEE countries are likely to shut plants will depend to some extent on future demand for electricity, and on its price; for the time being, some countries have become more reliant on nuclear power, because fossil fuels have to be paid for in hard currency.

The priority for both CEE countries and Western donors should therefore be to improve the management of nuclear plants, and to make low-cost investments that yield high returns in improved safety. CEE countries also need to put in place legislation to reassure western companies on the extent of their legal liability for refurbishment work done at nuclear plants. The absence of such legislation has been a considerable disincentive to western countries which want to undertake repairs and improvements of nearby CEE plants. In the longer run, proper pricing for electricity is essential, as it will allow choices on appropriate fuels to be taken in the right context.

A further problem is the safe disposal of nuclear wastes. Up to now, the former USSR has arranged for the disposal of radioactive wastes from nuclear reactors in those Eastern and Central European countries where it provided uranium, or enriched locally produced uranium. These waste disposal arrangements have been, or will shortly be cancelled. Wastes will increasingly have to be stored and eventually disposed of in their country of origin with the result that many countries in the region must now construct or expand waste storage and disposal facilities. Nuclear waste disposal involves varying degrees of hazard depending on the characteristics of the wastes and whether or not they are released into the environment.

Degradation of ecosystems and biodiversity conservation

Protected areas cover about 3-5% of the land area in most of the countries of Central and Eastern Europe. Most are classified as national parks, nature reserves, and specially protected areas. They generally encompass mountains and forests; wetlands and sensitive marine environments are not as well protected. In most of the countries, environmental degradation of protected areas has been quite limited. There are some notable exceptions, however. In the Czech and Slovak Republics, acidic deposition has adversely affected 75% of the protected areas and seriously damaged 25%, with the primary damage being to trees, while in Poland 6 out of 18 National Parks are located in zones designated as "ecological hazard" or "ecological disaster." Addressing the sources of environmental pollution will therefore reduce costs not just to human health but also to living natural resources.

More importantly, biodiversity conservation involves policy on agriculture, forestry and fisheries. The past practices of central planning in CEE countries, ironically, served traditional biodiversity conservation well. The growing trend toward decentralization, land privatization, and Western-style agricultural policies in Central and Eastern Europe creates formidable challenges for biodiversity protection, especially in the face of intense economic pressure to exploit natural resources beyond carrying capacity at a time when neither the law nor public money can offer much protection.

Biodiversity in CEE countries is richer than in Western Europe. It needs to be conserved at least as much to avoid the productivity costs associated with poorly functioning ecosystems than because of the potential irreversible loss of species. Maintaining biodiversity ensures functional diversity in the environment, which in turn promotes resistance to—and resilience from—disturbance (e.g. pests), adaptability (e.g. to climate changes), productivity of natural systems, and also serves as a warning indicator of critical changes in the environment.

Responding to the problem: Finding a balance between policies and investments

This chapter began by suggesting three stages in devising environmental policies. First, discover what people care about; second, examine the costs of achieving those goals; and third, look for the most cost-effective policies. But it has emerged from the chapter that governments face many possible goals, and may find it hard to choose among them. This section offers some thoughts on selecting priorities, and on choosing policy instruments.

Selecting priorities

A basic rule of thumb is to balance the costs of a policy against its likely benefits. Such an approach provides a simple basis for ranking alternative courses of action. The benefits of a measure are equivalent to the amount of environmental damage that would occur if the investment or policy were not implemented.[9] This is, of course, quite different from focusing on financial indicators of profitability, since both the benefits and costs are defined in a much broader sense: sound economic analysis also includes quantification and where possible valuation of social (equity) and environmental factors and looks at the costs and benefits of an investment or policy to the country as a whole.[10]

Benefit-cost analysis offers a method of thinking systematically about choices. It is a standard—though not always

correctly used—approach in market economies, but it has been largely absent in the formerly centrally planned economies. The fact that benefit-cost analysis has been in use for several decades does not mean, however, that it is easy or without controversy. It will always be hard to assess the benefits of any given policy because people differ in the value judgments they make about various forms of environmental damage. The priorities articulated in this document reflect first of all a general view about the paramount value of human health; beyond this, the priorities are based on what appear to be the value judgments by governments tackling environmental problems in most countries—rich and poor.

In principle, cost-benefit analysis means ranking priorities so that the first (or next) $100,000 spent will have the greatest impact in bringing about environmental improvement. This process can be continued until the limit of available resources has been reached. In practice, the approach will inevitably be more complicated. There are many possible projects with similar benefit-to-cost ratios in different sectors. The "pyramid" of priorities is therefore relatively blunt, and it is clear that many factors will contribute to what kinds of decisions are made.

The criteria described here serve as much to identify what should not be done, as what is urgent. For example, even if people set a high value on a particular kind of environmental damage, it may not be cost-effective to give high priority to dealing with it. Attention is bound to focus upon the most dramatic environmental problems, i.e., on cases where the costs of environmental damage are very high. However, sometimes the costs of remedying the damage may also be high. For example, addressing the problems of the unsafe disposal of hazardous and toxic wastes or of poorly-designed nuclear reactors may be judged to have high environmental benefits, but the potential costs of remedying all of the problems that have been identified are also likely to be very large. In such cases, inexpensive measures designed to make significant improvements would be more appropriate than massive programs of expenditure, most of which will have a relatively low benefit-to-cost ratio.

What is the problem, and how should it be solved?

Certain principles may assist policy makers in choosing policies. First, the environmental problem should be clearly defined, for that will largely determine the solution and the way it is implemented. This may seem obvious, but experience suggests that environmental solutions are frequently offered before the problem to be solved and the options for solving it are fully assessed. For example, there is a risk that investments are made which later on turn out not to have solved the real problem. Thus, money may be spent to reduce the pollution from a large power plant, when in fact most of the serious pollution is caused by home heating and small industries. Similarly, policymakers may argue that the "solution" to a problem of river pollution is a particular municipal wastewater investment. But the same money might be used upstream—to reduce effluents discharged by a small group of factories, say,—to make a larger impact on ambient water quality. If policymakers define the "problem" as improving ambient water quality rather than merely as treating municipal wastewater, they will make a wiser decision (see Annex 5). Applying the same way of thinking, it may not be necessary to install an expensive scrubber in a power plant if it is possible to temporarily close that power plant (and obtain electricity from other power plants in the grid) when weather conditions create dangerous levels of pollution. There may be many different ways to solve a given problem—some of them much less costly than others (see boxes in chapter V and Annex 6).

These considerations also apply to situations where inefficient environmental investments are proposed in order to deal with an underlying social or political concern. Thus, in some countries, high-cost end-of-pipe investments in the power sector are proposed in order to continue using low-quality coal so as not to become dependent on other countries for energy sources and in order not to close mines employing significant numbers of people. Again, there may be lower-cost approaches to obtaining the necessary electricity without causing serious air pollution or jeopardizing energy security, and where the economic savings can be more productively used to retrain unemployed mine workers.

Next, policymakers should look for measures that solve several problems simultaneously, and avoid transferring problems from one environmental medium to another.[11] As several environmental problems are sometimes related to the same cause (e.g. energy use or the use of certain minerals), some measures (such as energy conservation or introducing more efficient production processes in the metal industry) will reduce several kinds of pollution at the same time. Often, end-of-pipe measures, such as water purification or installing dust collectors, affect just one environmental problem; structural changes, such as changing energy use and fuel mix, restructuring industrial processes, or improving the quality of products, will influence several environmental problems simultaneously. A reduction in the use of coal, for example, simultaneously diminishes the risks to health from dust and SO_2, acidification, salinization of water and greenhouse warming. Such measures should therefore often be given priority. An advantage of such structural measures is that they reduce not only emissions but also the need for inputs (e.g. of energy and materials) and therefore have a financial payback.

Another principle that can be used to set priorities is that prevention always costs less than cleaning up or mitigating environmental problems once they have occurred.

Box 2.4 Cost savings for one medium-sized town

Szeged is a town with a population of 180,000 which currently has no municipal wastewater treatment system. Plans have called for a technologically advanced treatment plant, with a total investment cost of US$55 million. However, both local and regional water quality improvements would be small because of the nature of the receiving water. While it may be politically difficult to justify no investment at all, it is possible to design a sequence of actions that imply capital and operating cost savings of about US$53 million over the next 20 years (12% discount rate). These are savings for just one medium-sized town.

For example, in the long run it is cheaper to prevent soil pollution by producing less waste and carefully managing it than to clean up contaminated soils. Moreover, it is hardly sensible to clean up the soil before the waste stream is under control. Improving the efficiency of mining and industry—and thus reducing losses—and applying stricter rules in waste management will be more urgent than a general programme to clean up soil.

Because prevention is much better than cure, it is important to ensure that appropriate standards for the future disposal of dangerous wastes or for nuclear safety are introduced and enforced. Moreover, partial solutions which offer substantial environmental improvements at a modest cost may be strongly preferred to "permanent" but expensive measures. In setting objectives for environmental policy it is the incremental benefit-to-cost ratios that matter, since the basis of comparison must be how much environmental improvement can be obtained by spending an additional $100,000 on one problem rather than on another.

First look at economic policies

Some economic policies—including market reforms, higher energy prices and improvements in industrial efficiency—are "win-win" policies in the sense that they contribute to more rapid economic growth while also improving the environment. The costs of achieving the associated environmental benefits are low (they depend essentially on the available institutional capacity), so that such policies should obviously be adopted as rapidly as possible.

Environmental policies and investments

Targeted environmental policies—such as pollution charges, regulations which are carefully designed and enforced, and the establishment of appropriate property rights—are not costless, but their costs are typically low by comparison with the benefits that are generated by establishing appropriate incentives and institutions. The development of appropriate institutions is a lengthy process but crucial to the success of environmental investments. In the short run, constraints on institutional capacity may even mean that investments which might appear to have a large benefit-cost ratio ought to be deferred until they can be implemented most effectively (e.g. in the water sector through the creation of river basin management).

Conclusions

Balancing the many considerations is difficult. It is an art, not a science, since the range of factors that must be taken into account is large, and the quality of any data is often highly suspect. However, the general principles for establishing priorities can be summarized in the following four guidelines. They are complementary and must be applied simultaneously; all are necessary for environmental improvement.

- Support as much as possible those economic policies which also have environmental benefits: for example, market reform, and especially market pricing of energy, and economic and industrial restructuring, will bring a steady renewal of capital stock and better industrial management.

- Adopt targeted environmental policies which establish a framework of incentives and environmental institutions: for example, the system of fees and fines can be revised and consistently applied; environmental standards can be modified to help achieve significant improvements in environmental conditions at least cost; or water management can be reorganized in river basins to improve the efficiency of planning for water supply and treatment. Targeted environmental investments should be directed especially to those problems which will persist or even deteriorate despite market reform and/or industrial restructuring.

- Concentrate environmental expenditures on those projects with the highest benefit-to-cost ratios. In the short term this is likely to mean that measures to reduce air pollution take a larger share of spending, but investments with high benefit-cost ratios which deal with water pollution, land quality and the preservation of biodiversity should also be implemented immediately.

- Devote modest resources to programs whose benefit-cost ratios are expected to be near the top of the ranking in future but which have a long lead time from start to completion, such as certain investments to deal with vehicle traffic problems; natural resource and biodiversity conservation programs which require additional research and/or data collection; or wastewater management investments which depend on institutional reform.

One of the most important goals of the Action Programme is to show that difficult choices have to be made, and that resources should be concentrated on those problems where the greatest environmental benefits can be achieved relative to the costs.

Notes

1. The general principle of sustainable development adopted by the World Commission on Environment and Development (Our Common Future, 1987). Sustainable development implies that the stock of overall capital assets remains constant or rises over time. These assets include manufactured capital (machines, roads, and factories), human capital (human health, knowledge and skills), and environmental capital (forests, air, water and soil quality). Stated differently, countries can consume up to an amount that will not run down the overall stock of capital.

2. The effects of heavy metals and micropollutants are also potentially significant.

3. To the extent that polluting industries affect both the health of the communities in which they are located and, also, the workers who work there, a remediation strategy which targets environmental health problems will also be effective in capturing work places with significant occupational health problems. The best example of this is lead smelters, where significant community exposures to children and in-plant exposures to workers seem to coexist everywhere they have been measured in tandem in Central and Eastern Europe. There are some important exceptions to this general pattern which are discussed in Annex 2.

4. Elevated levels of particulate air pollution have been associated with declines in lung function or with increases in respiratory symptoms such as cough, shortness of breath, wheezing, and asthma attacks. Other studies have found associations between particulate air pollution and rates of hospitalization, chronic obstructive pulmonary disease, and restricted activity due to illness. (D.W.Dockery et al., An Association between Air Pollution and Mortality in six U.S. Cities, New England Journal

of Medicine 1993; 329: 1753-9. This article also refers to 18 earlier studies.)

5. Assumptions: Most emissions from low stacks are in urban areas. About 24% of emissions of SO_2 and NO_x, and 45% of particulate matter from low stacks are deposited in urban areas. Emissions from high chimney stacks are assumed to be fully dispersed and so to be either exported or deposited uniformly over the country. In the case of Poland, this implies that about 5% of emissions from high stacks are deposited in urban areas. Emissions from high stacks primarily cause forest and agricultural damage. All damage to health and buildings has been assumed to occur in urban areas, and all damage to forests and agriculture has been assumed to occur in rural areas. Monetary damage functions have been assumed to be linear functions of deposition above the critical load, so that the marginal value of a ton of avoided deposition is the same wherever the reduced deposition takes place.

6. Nevertheless, drinking water is not always safe. There has been an epidemic of waterborne hepatitis A in Riga (Latvia) as a result of a temporary lack of coagulant to treat drinking water from the Daugava River. In Jelgava, Latvia, an outbreak of milk-borne dysentery based on contaminated water has been reported. There is also evidence of infections from contaminated water in St Petersburg, Murmansk and Volgograd (in the Russian Federation, 60% of the population is believed to be exposed to unsafe drinking water).

7. Heavy metals and micro-pollutants could represent a serious problem, too, though they are not usually captured because of limited measurement capability. On the other hand, even in those countries that possess advanced instruments, there is a lack of funds to use them properly. Western experience shows that it is very difficult and expensive to measure/identify all the micro-pollutants and their impact. Micropollutants are best dealt with at the source.

8. Methemoglobinemia is a blood disorder; symptoms are bluish skin, faintness, and shortness of breath. Severe anemia occurs because the blood loses the capacity to carry oxygen.

9. The costs from actual environmental damage and the costs due to man-made (e.g. nuclear accident or species extinction) or natural (e.g. earthquakes) disasters are captured in the same framework. They are both expressed in terms of the willingness to pay either to avoid/remedy the damage or to reduce the probability of an accident.

10. "Shadow" prices are used when true economic values of costs are not reflected in market prices as a result of various distortions, such as trade restrictions, taxes, or subsidies. This applies as well to environmental "externalities" which only persist because of an implicit subsidy to the polluter.

11. For example, scrubbers to reduce air pollution create large amounts of solid waste.

Box 2.5 Airborne Dust or Gases—Which is More Important?

The work described in this report has come at a time in which new knowledge is rapidly emerging about the impact of air pollution on human health. Of particular interest is the role of certain gases and vapors (especially sulfur dioxide, oxides of nitrogen, ozone, and hydrocarbons) in precipitating acute respiratory episodes and exacerbating chronic bronchitis and asthma. At the same time, the impact of respirable dust on mortality (in addition to its role in respiratory morbidity) is being recognized from studies of a variety of large cities in the West with concentrations of ambient dust which are much lower than in many places in Central and Eastern Europe. The most recent study, by Dockery et al. (1993), which followed 8,111 adults in six U.S. cities for 14-16 years and which adjusted for age, sex, smoking, education level, and occupational health risks, found that the city with the worst fine particulate air pollution had a 26% higher mortality rate than the city with the least pollution of this kind.

Thus, from a health perspective, it is difficult to come up with a strong theoretical rationale to concentrate on either dust or gases to the exclusion of the other. In practice, the list of places in the region where airborne pollution threatens human health include some where the primary exposure is to dust; some where the primary exposure is to one or more gas or vapor; and many where the problem is a combination of the two. This same pattern holds true for regional hot spots, areas with a confluence of point sources, and areas where the "bad town planning" model best applies.

Knowledge of the relative importance of the health impacts of dusts and gases does not give a basis to set environmental action priorities which would target one and neglect the other. However, even if the health impacts of dusts and gases is similar, the cost of controlling the former is typically much lower. Strategies aimed at controlling dust while incidentally reducing gaseous emissions are therefore potentially the most cost-effective.

The following table shows typical costs of controlling particulates, SO2 and NOx emissions from coal-fired plant in the power and district heating sectors using pollution abatement devices. The results highlight the relatively low cost of controlling particulates compared with either SO2 or NOx emissions.

Typical Costs of controlling emissions from the power and district heating sectors

Pollutant	*Abatement technology*	*Removal efficiency %*	*Abatement cost ($ per annual tonne emission avoided)*
Particulates	Electrostatic Precipitators (ESP)	97 - 98	15 - 65
	High efficiency ESP	99 - 99.9	20 - 90
	Baghouse	99 - 99.9	15 - 65
	Mechanical Collector	50 - 90	10 - 70
SO_2	Dry sorbet	50 - 80	400 - 3,500
	Semi-dry FGD	80 - 95	600 - 4,000
	Wet FGD	96 - 98	800 - 5,000
NO_x	Low-NO_x burners	30 - 70	750 - 7,000
	SCR	80 - 90	5,000 - 45,000

Priority should be given to:

- fitting particulate control devices to plants that currently have no such facilities installed; and
- repairing or upgrading existing facilities that are currently not working to design capacity.

Chapter Three

Policy Reforms

Chapter Contents

The transition from central planning to markets should help to improve not only the countries' economic performance in the longer term, but their environments. Among the key factors are increases in energy prices, and hard budget constraints on public and private enterprises. These provide powerful incentives to reduce waste of resources and to improve industrial "housekeeping" in ways that reduce pollution emissions. Many CEE countries have already made big strides in raising energy prices.

Privatization should assist these changes, provided that liability for past environmental damage is clearly assigned, and enterprises are held accountable for all current emissions.

Markets are no panacea. Targeted environmental policies will also be required to ensure that the potential benefits of economic restructuring are fully realized. To achieve the most cost-effective use of resources, the CEE countries should, where possible, rely upon economic instruments to achieve environmental goals. Existing systems of pollution charges can be developed to provide an effective incentive for sound environmental practices. Simple market type approaches are not just realistic even in the current economic and institutional situation; they also provide the scope for large savings.

Where regulatory policies are more appropriate—especially to control emissions of heavy metals and toxic chemicals—governments could adopt either the EU framework of standards or an equivalent system which provides a 10–20 year adjustment period. The implementation of stricter emission standards should be phased, allowing industries an extended but well-defined period to comply with them. Ambient standards should be used to guide local policy making.

The greatest contribution to achieving a continuing decline in total emissions is likely to come from improving the environmental performance of old plants which continue to operate in the medium term.

The Effects of Economic Change on the Environment

The shape of environmental policies and investments in Central and Eastern Europe will be determined by the profound economic changes which are transforming incentives, institutional arrangements and the composition of economic activity. The transition from central planning to markets will eventually improve both economic performance and environmental performance. In the past, production involved massive waste of resources. Now, incentives which encourage the more efficient use of energy, minerals and water will also reduce air and water pollution. As enterprises have to take account of the true opportunity cost of capital, the *emphasis will shift from large capital investments that use the products of heavy industry towards a continuous process of replacing existing capital equipment and incorporating new technology.* As a result, the average amount of pollution generated per unit of output will decline. These structural changes will take time, but they will have a large impact on emissions over the next 10–15 years.

Economic reform will not and need not be justified on environmental grounds. Still, many (though not all) of the policies which make up the typical reform package in Central and East European countries—macro-economic stabilization, pricing reforms, privatization, industrial restructuring and trade liberalization—can be expected to contribute to reducing environmental degradation. Environmental considerations simply reinforce the case for implementing these reforms as rapidly as is politically possible.

Privatization may contribute towards improving environmental quality, provided that clear, credible and enforceable environmental regulations are in place. How-

Box 3.1 Short-term threats to the environment in Russia during the transition

In its recent State of the Environment report for 1992, the Russian Government identified the following ways in which the current economic difficulties might threaten the country's environment:

- Inadequate expenditures on maintenance and capital replacement could lead to serious environmental accidents and more routine spills and wastage.
- A shift to poorer quality raw materials and, with higher prices for exportable oil, to coal may lead to greater dust emissions and the creation of more solid waste.
- An increasing risk of illegal logging, more reliance on clear-cutting and poorer forest management could threaten large areas of the Taiga, especially in Eastern Siberia.
- Weaker enforcement on controls on hunting and fishing plus intrusion into protected areas by poachers may deplete wildlife stocks, especially of some endangered species. This danger would be exacerbated by a shortage of money to staff the agencies responsible for the management of protected areas.
- The decentralization of government responsibilities might encourage local authorities to assign rights to exploit natural resources without imposing appropriate requirements to protect the environment and without ensuring that the natural resources are properly managed.

The Government's primary recommendations concentrate on (i) the need to avoid environmental accidents caused by bad maintenance and management, and (ii) the importance of providing resources and strengthening the institutions concerned with protecting natural resources such as timber, wildlife and rare habitats.

ever, *competition* often determines the behavior of enterprises as much as the form of ownership. Policies to promote competition, including breaking up large monopolies, are as important as privatization in obtaining the best response to higher energy prices, pollution taxes or regulatory measures. Privatization clarifies the task of management, and allows it to concentrate on operating efficiently and profitably subject to meeting environmental constraints. There will, of course, be bargaining over what those constraints should be, but the negotiations will take place between parties with clearly defined responsibilities.

Economic decline in Central and Eastern Europe in the last three years has already resulted in a reduction in emissions and this will continue up to at least 1995. However, this decline provides nothing more than a temporary abatement of the pressure on the environment. The critical question is whether emissions can be stabilized or reduced further as economic activity begins to recover from the deep recessions that have accompanied economic transformation. The earlier the initial decline is reversed, the more stringent will have to be the policies that are implemented to prevent a worsening in environmental conditions.

How will the economic transformation of Central and Eastern Europe affect the environment?

To answer this question, a number of scenarios have been prepared for the Action Programme, based on analysis of the structural, institutional and microeconomic changes expected to occur in the economies of Central and Eastern Europe over the next two decades.

Forecasting the impact of economic transformation in Central and Eastern Europe on the environment is fraught with difficulty. Even short-term predictions about the macroeconomic consequences of stabilization programs or about the behavior of enterprises have proved notably hard to get right. Without some idea of the nature of the changes that are likely to occur over the next decade, though, *huge amounts of money could be wasted on investments in environmental improvements which turn out to be redundant.* An important by-product of economic change will be extensive environmental gain: The environmental damage associated with excessive energy use and with some forms of heavy industrial production will fall sharply. It is therefore important to have a vision of what the economies will look like in 5 or 10 years' time.

Some of the short-run effects of economic transition on the environment may be harmful. This has particularly worried the Russian government that has considered how to address these problems (**Box 3.1**). The concerns Russia identified are mainly related to weaknesses in the framework of environmental policy and under-funding of government monitoring and enforcement activities, rather than to the economic transformation itself.

Broadly, the economic transformation is likely to affect the CEE economies in two ways. First, the *structural changes will reduce demands on the environment.* These changes will be encouraged by the removal of energy subsidies and the proper pricing of energy, and by privatization. They will bring about new investment in less polluting technologies. Second, *when growth resumes, it will create new environmental pressures.* The rest of this section looks at the way structural change will influence the environment, and at the main findings of the scenarios. These show clearly that economic reform needs to be backed up with environmental policies. Later parts of this chapter discuss the range of policies from which CEE governments can choose.

The most important structural influences on environmental prospects in the short and medium term are as follows:

- The shares of national income devoted to investment have already declined dramatically. Even as the economies recover, investment shares, particularly in heavy or basic industries, will be much lower than in the past because investment was so inefficient. This implies a permanent drop in the demand for the output of heavy industry relative to national income.

• The composition of private and public consumption will gradually change in a number of ways. Overall, a smaller fraction of income will be spent on industrial goods, and a higher share on processed foods, paper and chemical products, and transport equipment. Spending on services will also grow rapidly. The implication of these changes is that growth in industrial output will lag far behind aggregate economic growth, while, within the industrial sector, there will be a shift from activities which are important sources of air pollution to those which discharge water pollutants. The growth in private transport and in packaging will pose new problems for cities and towns in coping with traffic pollution and municipal waste.

• The past emphasis on meeting output targets meant that many industries were notoriously wasteful in their use of materials (including energy), labor and capital. Simple changes in the organization of production will allow enterprises to reduce such waste, to eliminate over-manning and to get more output out of the same stock of capital. The economies will thus be able to produce more final output for the same volume of resources and other inputs, thereby reducing the amount of waste they generate.

• Economic restructuring will also eventually lead to new investment. The replacement of old plant and equipment by new capital embodying modern technologies brings an environmental "free lunch."[1] In response to the need to meet stricter environmental standards in the West, the designers and manufacturers of capital equipment and plant have developed new processes and machinery which generate much lower emissions than in the past. Even without a need to meet tighter emission limits, it will be economically efficient for industries such as textiles, paper, chemicals and metallurgy to invest in capital which will bring substantial reductions in their average levels of emissions per unit of output. The main scenarios presented below are based on these environmental improvements, combined with the assumption that new plants will be required to meet emission standards typical in North America and Western Europe (though not in West Germany where standards are stricter).

Removing energy subsidies

One of the main forces driving structural change, and one of the most painful but essential features of the market reforms in all countries in Central and Eastern Europe is to raise the basic level of energy prices paid by industry to world market levels or higher. This can be justified solely on grounds of economic efficiency (see **Annex 4**) but the changes will have

Box 3.2 Privatization and Environmental Liability

Uncertainty about responsibility for past environmental damage is a significant discouragement to foreign investment, especially in heavy industries. A survey of large North American and European corporations conducted by the World Bank and the OECD found that companies that had made or considered investments in the region rated environmental risks on a par with many factors usually considered important in foreign investment decisions, including exchange rate risks and political risks. The companies most concerned about environmental issues were companies in highly polluting industries (mining, chemicals, pulp and paper, petroleum refining, and ferrous and non-ferrous metals), companies with less investment experience in the region, and companies that follow relatively strict corporate environmental policies.

At the same time, not enough attention has been paid to problems of environmental liability in domestic privatization programs. Part of the problem is an absence of information about the causes and extent of past damage. In theory, with complete information, the issue is straightforward: either the government accepts responsibility for dealing with the consequences of past damage or the obligation is transferred along with the assets of the enterprise and reflected in their price. In practice, it is the lack of information about what has been done in the past that gives rise to the greatest difficulties. It is essential that responsibility for past environmental problems be decided before privatization, when property relationships are still simple. This requires: (a) clear legal rules—either in legislation or in specific contracts—defining how any costs will be allocated; (b) where possible, technical information on the extent of pre-existing contamination and the potential costs of rectifying the damage; and (c) an administrative decision about what remedial action is required. The extent of past liability should be established as clearly as possible at the time of ownership transfer to avoid the kind of uncertainty and protracted legal battles that can otherwise be expected in the future.

Ministries of Environment will need to work with the authorities responsible for privatization to negotiate the environmental aspects of large individual deals and to provide general guidance in the case of medium and small enterprises. Practical considerations imply that, in one form or another, governments will bear the costs of dealing with past pollution. The funds and staff required to carry out detailed environmental inventories dictate that these should be limited to a small number of the largest enterprises, especially when foreign investment is involved.

Once an environmental audit has been completed, then the terms of the privatization can specify the environmental clean-up that is to be undertaken by the new owners and the discount built into the sale price to take account of the costs involved. Both parties must be realistic in the negotiations. Potential purchasers, especially those from countries with very strict environmental regulations, may be inclined to allow for a more comprehensive clean-up than the government would choose to undertake. On the other hand, the new owners will have an incentive to minimize the costs of meeting their clean-up objectives and should be able to act more rapidly. On isolated sites where the nature of past pollution can be clearly identified, the balance of advantages is likely to lie with accepting a lower privatization price in return for a commitment to undertake specific remedial actions. Where multiple sources or great uncertainty is involved, governments would be best advised to retain the responsibility for rectifying past damage.

After privatization, enterprises must be fully responsible for the consequences of their emissions. If they inherit old, polluting plant and equipment which must be modified or replaced to meet current environmental standards, this will be reflected in the value of the assets. The government for its part must be willing to define the environmental standards that the privatized enterprise is required to meet and the period of adjustment that will be permitted. To ensure that this means something, Ministries of Environment must set up monitoring systems to track the performance of newly privatized enterprises as well as those remaining in public ownership.

large environmental benefits. The after-tax prices paid by industry and households may rise further, to Western European levels, if governments decide to impose taxes on the consumption of energy either to generate revenue to reduce fiscal deficits and/or for environmental reasons. The extent of the adjustment in real energy prices will vary greatly across countries and between industrial and household consumers, since households are more dependent on subsidized energy such as electricity and district heat. A comparison of prices paid by industrial users prior to the reforms with those typical in Western Europe implies that the range of the necessary increases in energy prices relative to the prices of other industrial goods varies from less than 25% in Hungary to over 300% in the former Soviet Union. All countries, including Russia and other states of the former Soviet Union, have raised real energy prices substantially over the past 2-3 years.[2] As a result, the process of adjustment is largely complete in Hungary, is well advanced in the Czech Republic, and Poland, but has only just started in the Russian Federation and other FSU countries.

Allowing energy prices to rise to market levels will have two effects which have a bearing on air pollution:

- It will promote energy conservation, so that the energy intensity of economic activity is likely to fall in most countries by one-half over the next decade; and
- It will also bring about a shift in the composition of fuel use.

Historically, governments have encouraged the consumption of domestic sources of energy. In most Central and South-East European countries this means that coal was favored in order to reduce dependence upon imported supplies of oil and gas. In the Russian Federation, the preference was for oil and, more recently, for gas whose environmental effects are more benign.

There will be large relative shifts in the prices of various fuels. The prices of coal in Bulgaria, the Czech Republic, Hungary, Poland, and Slovakia have to rise much more than either oil or gas prices to come into line with West European prices. As a consequence, significant increases in electricity and heat prices will be required (because these are a function of coal prices). These changes will encourage substitution towards oil and, especially, gas in all uses including power stations (because the price of coal will no longer be so attractive), and that in turn will tend to reduce emissions of most air pollutants. In Russia and other FSU countries, the relative price movements will bring less clear environmental benefits, though they are likely to encourage the continued substitution of gas for other fuels.

The difficulties of making the adjustment should not be underestimated. Provided that the long run goal of raising energy prices to market levels is clearly promulgated, it is reasonable to *phase the increases over a period that reflects the economic and social costs of adjustment.* Some countries have felt that their economic situation does not permit a gradual series of price increases, while the circumstances of other countries may be such that concerns about a rapid rise in unemployment are more important. The crucial issue is that this progress should be sustained with, if necessary, transitional assistance to vulnerable enterprises and households which bear the brunt of the adjustment. However, such assistance should not be tied to current levels of energy consumption so that those concerned have an incentive to conserve energy wherever that is possible.

Other sectoral policies

While energy subsidies stand out for their overall impact on the environment, many other sectoral policies are both economically and environmentally undesirable. In agriculture, fertilizer and pesticides subsidies have encouraged the careless and excessive use of these inputs with the result that agricultural run-off has had a serious impact on both surface and ground water quality in many CEE countries. Special assistance for intensive livestock operations has greatly exacerbated this problem in some regions. The reduction or removal of these incentives over the last three years has led to a marked improvement in rural water quality in Poland, Bulgaria and the Baltic states.

Natural resources used to be underpriced in all of the CEE economies. As a result, economic considerations played little role in decisions about the exploitation of reserves or the use of natural resources as industrial inputs. It was common to mine very low grade reserves, thus causing disproportionate environmental damage per tonne of concentrate. At the same time, recovery rates were typically low so that the residual metal contents of spoil heaps was high which led to continuing problems of heavy metals leaching into rivers, lakes and groundwater. Similar problems characterized forestry operations despite the centralized control of State Forestry Services. On the other side, the metallurgical, pulp and wood processing industries had little incentive to economize on their use of raw materials. Many of the environmental problems associated with these industries can be traced to the neglect of simple measures designed to reduce the waste of raw materials or of intermediate products. Audits of large plants in CEE countries have identified an enormous number of (often highly) profitable opportunities to reduce losses of inputs or to recover valuable materials from waste streams, which will generate significant environmental benefits provided that natural resources and other inputs are efficiently priced.

Fiscal policies

The transition from central planning has caused a fiscal crisis in most countries as traditional sources of revenue have collapsed while governments find it difficult to collect new taxes. Government spending on environmental protection has come under great pressure. In an attempt to offset any public expenditure cuts, Ministries of Environment and other environmental groups have sought tax privileges for environmental expenditures by enterprises and other private bodies. Experience suggests that these efforts are likely to be self-defeating. Special tax privileges for one sector rapidly proliferate, so that their ultimate effect is to encourage rather than discourage activities which cause environ-

mental harm. During the transition the prime concern must be to eliminate tax and other incentives which damage the environment. Once this has been achieved, the next step is to penalize such activities by, for example, imposing heavier taxes on leaded gasoline rather than on unleaded gasoline or on other highly polluting fuels. Such measures improve the government's budgetary position while reinforcing the incentives to reduce environmental damage.

Scenario analysis

Key results from the scenario analysis are shown in **Annex 3** and **Map 4**.[3] These are taken from two complementary studies carried out by RIVM in the Netherlands[4] and by the World Bank.[5] The World Bank study, based on a detailed industrial model summarized in **Annex 3** focused on the links between the nature of economic and industrial reform and the environment. On the other hand, the RIVM study used a slightly different model to focus on the technical possibilities for reducing emissions and on the spatial distribution of pollution. This study shows how economic reform combined with different environmental standards affects the average concentrations of key pollutants across the region and provides the basis for identifying how policy may alter conditions in environmental hot spots.

AIR POLLUTION. The results of the scenario analysis show that the environmental benefits of economic reform can be high. In many countries, total emissions of particulates and sulfur dioxide decline by 70 percent or more in the period 1990–2005, even if their Gross Domestic Product recovers to pre-reform levels. Declines of 50 percent or more in other air pollutants such as NO_x, air-borne lead and cadmium are likely. However, in order to sustain these declines over time, and to achieve them in countries where some pollution levels are very high to begin with (especially in the FSU), policies will be needed to restrict emissions below the level that can be attained at a negligible cost by modern technology. In particular, emissions of NO_x and lead may grow rapidly in the next century as a result of traffic growth unless measures are adopted to improve the environmental performance of motor vehicles and/or to limit their use in polluted urban areas.

The crucial question is whether tighter emission standards should be imposed on all plants or only on new or rehabilitated plant and equipment. The scenarios show that, for most pollutants, the *environmental gains from imposing EU standards on new capital alone are modest.* In order to achieve the very large reductions in emissions that are shown to be possible by 2010, it will be necessary to insist on retrofitting or scrapping old capital which does not meet these emissions standards. The costs of accelerated capital replacement would partly be covered by the greater efficiency of new capital, but nonetheless the financial burden is likely to be large. *A program that requires retrofitting or capital replacement for all plants in hot spots but not elsewhere would certainly offer the most cost-effective way forward* if governments wish to go beyond what can be achieved by imposing stricter environmental standards on new or rehabilitated plant and equipment alone.

Projections such as these show *what* can be achieved, given the technology that is readily available in the West, but they do not tell us *how* it should be done. Emission standards are only one possible instrument of environmental policy. The analysis later in this chapter indicates that other instruments may be preferable on economic or institutional grounds. Further, the fact that emissions could be reduced by the amounts shown does not imply that this should be the target for environmental policy in all or any of the countries. For example, even stricter emission controls via the application of Best Available Control Technologies (BACT) would reduce average emissions per square kilometer in Central and Eastern Europe to a level only one-fifth of that in Western Europe because of differences in income per head and population density. A BACT-approach would, therefore, make sense only in regional hot spots, even if the goal is to achieve ambient environmental conditions equivalent to those in Western Europe.

The *phasing* of stricter environmental controls must be considered carefully. To the extent that a country is going to rely upon the application of stricter controls to new plants, it is essential that appropriate standards or other instruments should be introduced *before* investment recovers after the trough of the economic recession is past. The scenarios suggest that environmental policies and investments which reduce emissions will reinforce the effects of economic reform and restructuring.

Some old and highly-polluting plants will be allowed to continue operating because the social costs of closure are too large to be contemplated. Even so, it is possible to insist that such plants improve their environmental performance without committing any significant amount of investment. Large gains can be achieved by simple "good housekeeping" measures—better maintenance, mending leaks, installing better controls, insisting on stricter standards of plant and process management. Indeed, if enterprises improve their environmental performance in these ways, their economic results are also likely to get better (chapter V provides some specific examples). It is crucial that governments should not direct all of their resources—human as well as financial—towards new investments or enterprises, since remarkable improvements can be made if the managers of old plants are pressed to make improvements and rewarded appropriately when they succeed.

Costs must play a central role in setting emission reduction targets. It is much cheaper to install dust collection and filtering systems on both new and old plant than to install some kinds of sulfur or NO_x emission controls, and the benefits are likely to be higher (see chapter II). Thus, it is sensible to aim for larger reductions in emissions of particulates, air-borne lead and heavy metals than of gases. The relationship between the costs of control in new and old plants is important in deciding how far to go in retrofitting or scrapping old plant, which in turn determines the length of the transitional period that should be allowed and the stringency of the intermediate emission standards.

The scenarios show that large sources such as power and heat plants and heavy industrial plants account in some countries for nearly 80 percent of dust and sulfur dioxide *emissions* and 50 percent of lead *emissions* (**Annex**

3). Thus, applying EU standards (or their equivalent) only to large sources will achieve almost as much as applying them to all sources, large or small. That is just as well: in general, it is much easier to monitor and enforce environmental policies that apply to a small number of large sources than to many small sources. Some instruments—e.g. differential fuel taxes, regulations concerning fuel specification or vehicle equipment—can be applied uniformly to all sources but substantial resources are needed to ensure that they are not nullified by poor maintenance. Economies of scale in control technologies combined with institutional considerations mean that environmental *policies* should focus on large sources initially. This needs to be carefully distinguished from public environmental *investments* which may in some cases be more appropriate in the household and small-scale industry sector (**Box 3.3**).

To control emissions of NO_x, VOCs and lead from vehicles will eventually call for the installation of catalytic converters on all automobiles. This will take a considerable period to come into effect. In the short run, product standards can be changed to reduce the lead content of gasoline. Indeed, *automobiles without catalytic converters can operate on unleaded gasoline.* Controls on vehicle emissions will be required in due course because of the expected growth in traffic volumes, but these are not an immediate priority and could be left until after 2000 which allows time for the efficiency and cost of control equipment to improve.

WATER POLLUTION. The scenarios show that emissions of BOD and other water pollutants barely decline or rise after 1995, even if large reductions in industrial emissions occur. Households and small sources dominate the discharge of these pollutants and the only effective solution is large scale investment in municipal wastewater treatment. This will take several decades and the effect on water quality will vary greatly from place to place. It is thus essential to ensure that scarce resources are allocated to maximize the improvement in ambient conditions by choosing the most cost-effective methods and standards of wastewater treatment.

CONCLUSION. The lesson of the scenarios is that structural change *alone* will not secure long-term environmental quality. But governments will not find it easy to phase in strong environmental policies while their economies are in transition. *The costs of environmental damage, especially to human health, are as real and as potentially large as the other social costs of industrial restructuring.* They tend to be less visible and more long term in character, but they should not be neglected on this account. It is therefore important that Ministries of Environment should work with Ministries of Finance, Industry, Privatization and Health to ensure that environmental considerations are built into decisions about which plants or enterprises in the public sector should be closed and which should be allowed to continue to operate. By affecting the pattern of closures and the conditions which must be met before plants receive assistance to support their continued operation, the environmental authorities can have a significant impact on the damage caused by old plants.

Better Environmental Policies

Most Central and Eastern European countries have environmental legislation which could be used even now to bring about improvements in environmental conditions. In the past, local and national governments were unwilling to enforce their own rules because priority was always given to maintaining levels of production. As more power is given to environmental agencies at a local level and as governments disengage from direct involvement in the ownership and management of industry, it should become possible to establish an effective system of environmental regulation. However, the choices will be difficult. With falling output and rising unemployment, the authorities may be understandably reluctant to enforce strict environmental rules if that means closing down industrial plants.

Once environmental priorities have been drawn up, policy instruments have to be chosen. The choice is sometimes posed as one between "command-and-control" (CAC) approaches, which use regulatory instruments such as emission permits, and "market-based" (MB) approaches which rely on economic incentives such as pollution charges or taxes, tradeable discharge permits and deposit-refund schemes. Politicians and industrialists generally prefer a command-and-control approach, because regulation offers the prospect of certainty in achieving pre-determined emission limits and is generally regarded as easier to implement.

On the other hand, there is overwhelming evidence that, in most circumstances, it is much more costly to achieve some level of emission reductions with command and control rather than market-based instruments. The reason is that the cost of cleaning up emissions is not the same for all sources. Therefore, the cheapest method of meeting the reduction target is to encourage those with the lowest costs of clean-up to reduce their emissions by

Box 3.3 Reducing emissions from coal-burning

1. Over the medium-to-long term, households and other small-scale users of coal are likely to switch to gas and other fuels. Coal-burning will therefore become increasingly confined to large users (as in Western Europe);

2. In the short run and during the transition, the damage to the environment and to health from the use of coal by small businesses and households will continue to be high, partly because these users will not be able to afford to change;

3. It is desirable that the reduction of emissions from low chimney stacks should be faster than that which would occur as a result of economic forces alone (see 1). It is therefore legitimate for this to be part of a public investment program;

4. At the same time, however, environmental standards and policies should be used to ensure that large coal users reduce their emissions. Enterprises and utilities should be encouraged to internalize the environmental costs of their activities and should generally finance their own investments (see chapter V).

more than those facing higher costs. This may appear to be inequitable to the different industries or plants involved, but why should different rules apply to responsibility for environmental cleanup than to other aspects of economic production: industries invest in specific countries and locations where they have a comparative advantage in terms of the costs of physical inputs, labor and capital. Similarly, polluters should clean up more where they have a greater comparative advantage. This is an essential condition for economic efficiency.

The severe financial constraints in Central and Eastern Europe suggest that the governments in the region might have to give more serious consideration to market-based instruments than has been usual in Western Europe. Moreover, some of the environmental issues which are receiving attention—such as wastewater treatment or acid rain—are among those where the costs of relying on CAC approaches are particularly high.

Even though CEE countries have embryonic markets at best, the use of MB instruments is not as unrealistic as might seem at first. In several of the countries in the region, there is paradoxically a fairly long tradition of environmental charges which have been applied with varying effect. Moreover, there may be institutional mechanisms (*e.g.*, negotiated emission permits) for simulating the use of market-based instruments, until such time as these can be applied directly. It is important to note that this is not necessarily a substitute for—but rather a complement to—emission limits, provided these are well enforced and take account of regional variations in ambient conditions.

In practice, the choice comes down to some combination of the CAC and MB approaches. The key problem is one of information and monitoring. There is little point in relying upon either emission permits or pollution charges unless appropriate arrangements can be made to monitor either or both the volume and concentration of discharges. As past experience in Central and Eastern Europe shows, mandating particular technologies or controls may be ineffective if poor operating and maintenance practices are allowed to render them partially or wholly ineffective. In all cases environmental policy has to rely upon a reasonable degree of voluntary compliance by enterprises and pollution sources as a purely adversarial relationship is likely to delay the implementation of, or undermine the effectiveness of both regulatory measures and market incentives.

For mass pollutants—such as dust, sulfur dioxide, BOD and suspended solids—and/or large sources, market-based approaches are both feasible and attractive, especially where there is a range of production processes and control options or where technology is changing rapidly. For micro-pollutants and/or small sources, the problems of monitoring are much more intractable and either specific regulations or indirect market incentives via the cost of inputs may be the only effective alternatives. Since there may be substantial uncertainty about the costs and consequences of adopting alternative instruments, an important consideration guiding the choice must be the relative costs of making mistakes, that is, of imposing too strict controls or achieving too little reduction in emissions.

Detailed assessments are needed of the suitability of different combinations of instruments for dealing with various environmental problems in Central and Eastern Europe. These must focus on practical issues of implementation as well as an economic assessment of the relative costs of the alternative approaches.[6] But at this point, it is possible to reach some general conclusions:

- A *regulatory approach* is usually the right way to deal with micro-pollutants such as heavy metals and most toxic chemicals. The costs and difficulty of monitoring emissions of such pollutants are large, the costs of making mistakes often high, while the range of control costs seems to be relatively small. Appropriate regulation includes technology standards which require enterprises to install certain kinds of process or end-of-pipe controls;
- *Emission standards* or *limits* may be used either to mandate use of a specific technology or as instruments to achieve a desired level of environmental quality outside the plant concerned. The former has been the usual approach in Western Europe while the latter was the intention of legislation in the former Soviet Union, though it was rarely effective in practice. Since continuous monitoring of emissions may not be possible or may be prohibitively expensive, it is common to rely upon random spot checks or a regular schedule of intermittent monitoring to enforce the standards.
- *Pollution charges*—which have a tradition in a number of CEE countries—can be used in dealing with emissions from large or medium industrial plants that can be monitored at reasonable cost. This includes air pollutants such as dust, sulfur dioxide, nitrogen oxides as well as water pollutants such as organic material, suspended solids and some heavy metals. Where pollution charges have been applied in the past in CEE countries, they have usually been set too low to cause any change of behavior among enterprises;
- *Tradeable discharge permits* have an advantage over pollution charges in that they offer relative certainty about the total level of emissions. However, they can offer an effective alternative only if the number of sources within the area covered by the permits is sufficient to sustain a reasonable level of permit trades without any one source having a disproportionate influence on the market. The main experience of using tradeable permits has been in the United States. There a scheme for phasing out lead in gasoline was successful, but other schemes have been less so. The 1990 Clean Air Act is expected to lead to a large increase in the role of permit trading in meeting overall targets for reducing emissions of sulfur;
- The principal problems in introducing market-based instruments arise from the distributional consequences of alternative levels of charges or permit allocations. It may be necessary to adopt transitional arrangements which mitigate the immediate impact of the new control system on existing sources. For instance, pollution charges could be increased gradually or a substantial share of permits could be allocated to existing sources. Such provisions may play an important role in ensuring that proposed schemes are politically acceptable. Until recently, environ-

Box 3.4 Finding the most efficient way to reduce environmental pollution

Setting a broad environmental quality goal and allowing enterprises to find the most efficient way to meet that goal can be far more effective than introducing regulations which prescribe specific controls for specific sources of pollution.

A good example is provided by a refinery of a major United States oil company which was forced as a result of narrow regulations to solve relatively minor pollution threats at major expense while far more important problems were neglected.

Specifically, the oil company was required to spend US$31 million to rebuild the refinery's waste water treatment plant to prevent 3 tons of benzene, a toxic chemical, from evaporating into the air annually. At the same time, 15 tons of benzene pollution annually is evaporating from a part of the plant not yet addressed by the environmental regulation: the marine terminal on the river where ships unload oil and load gasoline. Controlling benzene pollution there would have cost only about US$6 million. But oil company officials will not do anything until the regulations are made final in two or more years. The reason for the reluctance is that the regulations now are so specific in defining how a company should control pollution that if the equipment did not exactly fit every requirement, it might have to be dismantled, making the investment a waste.

mental policies in the OECD economies were based primarily on CAC approaches, but there is now a significant shift towards greater reliance upon market incentives as the costs of meeting stricter environmental goals have increased. Countries such as the United States, Netherlands and those in Scandinavia have put tradeable permits, effluent charges or environmental taxes at the core of their policies to tackle major environmental problems;

- *Product charges and deposit refund schemes* have been used with considerable success in many countries to deal with various types of solid waste and to encourage recycling of glass and aluminum. This approach is now being expanded to control the disposal of hazardous wastes in Thailand and other proposals are under consideration elsewhere. There is considerable scope for introducing similar arrangements in Central and Eastern Europe in order to provide appropriate incentives to reduce the generation of waste as well as to ensure that it is properly managed.

Pollution charges

Several countries in Central and Eastern Europe—including Bulgaria, the Czech Republic, Hungary, Poland, Russia, Slovakia and Ukraine—have legislation which allows Ministries or provincial governments to impose emission fees and fines on polluters. In many other countries—for example, Belarus and Croatia—such legislation has recently been introduced or is being actively considered. Such emission fees and fines can form the basis for efficient systems of pollution charges.

In most countries, it will be necessary to raise the level of the charges dramatically and then to enforce payment of the charges levied. This will provide a very powerful incentive to enterprises to find low cost methods of abating their emissions, *even if they cannot afford to make large investments in new plant and technology.* Often, good environmental management is just a reflection of good industrial management. The great merit of pollution charges is that they mobilize the ingenuity and skills of plant managers while they avoid the danger of enforcing technology standards which may be unnecessarily costly or rapidly outdated (**Box 3.4**).

A clear distinction must be drawn between (a) fees for emission permits or pollution charges whose purpose is to cover the administrative and monitoring costs involved in any system of environmental regulation, and (b) pollution charges which are linked to the amount of damage caused by emissions. Reliance upon cost-based fees to finance regulatory expenditures are common in Western Europe and should be regarded as a minimum requirement in the CEE countries to ensure that the environmental authorities have sufficient funds to fulfill their basic responsibilities for monitoring and enforcement. Pollution charges generate additional government revenue that can be used for any purpose, though in practice it is usual to use the revenue to finance environmental expenditures via an Environment Fund or an equivalent arrangement. While linking revenues and expenditures is generally not recommended—the effect may be to induce inefficient taxation or spending—the loss of economic efficiency may be a political price worth paying in order to introduce an effective system of pollution charges. So long as cost-based fees are used to finance the fundamental regulatory functions, it does not matter too much if the rest of the revenue from pollution charges is used solely to finance environmental improvements. A fall in the amount of revenue collected would indicate a decline in total emissions and thus in the clean-up expenditures, so that the arrangement provides a greater degree of flexibility in setting expenditure levels than is typical for most other assigned taxes.

Poland has raised the level of its pollution charges by about 10 times in real terms since 1990, providing a genuine incentive to reduce emissions. The revenue collected in this manner goes to national and provincial environment funds and is used to finance various environmental investments. There have been problems in collecting the revenue from many enterprises whose financial situation was, or was claimed to be, such that they could not make the payments for which they were liable. In the Katowice region—one of Poland's most polluted (but wealthiest) areas—only 26% of all environmental fees and fines were collected in 1992. The Ministry of Environment announced in late 1992 that pollution charges would be reduced temporarily by 90 percent to allow industries time to adjust. The negative reaction to this decision from enterprises and from environmental groups has demonstrated that the pollution charges were having their intended effect of encouraging polluters to invest in reducing their emissions (some enterprises had apparently already started to make investments in response to these changes and perceived the reduction as unfair). Abrupt changes in the level of charges disrupt plans based on the assumption that the charges will be much higher than in the past.

Pollution charges are generally set too low. In Poland the charges for emissions of saline water are not set high enough to force the mines concerned to control their discharges (though the sharp increases in charges has prompted the mines to give serious consideration to more limited measures designed to reduce emissions). In this case the government was concerned that charges set high enough to reflect fully the damage caused by saline water would cause the mines to shut down, destroying jobs and forcing greater dependence upon imported energy. While this view is understandable, it neglects the fact that the costs of the damage caused by saline water are equally real even though they may be not be immediately apparent to the many enterprises and other organizations which have to bear them.

Poland's experience with pollution charges suggests lessons for other countries. Two main issues must be addressed in implementing any system of charges:

- The relationship between regulations and economic instruments must be carefully considered. In Poland, emission standards have not been linked to pollution charges either in the way they operate or in the implied weight placed on reducing emissions of different pollutants. Enterprises are confused and feel that they are being unfairly subjected to inconsistent signals;
- An efficient system of pollution charges that reflect the environmental damage caused by emissions will impose a heavy fiscal burden on enterprises that have never had to meet strict environmental standards in the past. Since the financial position of many enterprises is already weak, enforcing payment may lead to bankruptcies while a failure to levy the charges due will undermine the credibility of the system.

Both of these issues are much more acute during the transitional period while enterprises adjust to the new policy regime than they are in the long run. Those regulations which are retained can be amended or eliminated to ensure that they do not undermine the impact of the pollution charges.

Various arrangements can be introduced to cushion transitional difficulties. None is ideal, but countries could consider one or a combination of the following:

- Impose a relatively low charge on emissions up to the level specified in each plant's emission permit but require that the full charge should be payable on all emissions above that level. This is equivalent to the original system of fees (low pollution charges) and fines (full pollution charges) which was or is still operated in several countries. It provides a strong incentive to reduce emissions to the permitted level, but sacrifices some of the efficiency gains which can be achieved by encouraging plants with low control costs to reduce their emissions below the level specified in their permits. For this reason, the quantity of emissions subject to the lower charge should be gradually reduced to zero over a period of 3-4 years;
- Apply a uniform pollution charge to all emissions which is gradually increased over a period of years to the level implied by estimates of the damage caused by emissions. This approach provides less of an incentive to reduce emissions immediately, but may be more practical if emission permits are ambiguous or have not been issued for many sources;
- Impose the full rate of pollution charges from the beginning, but introduce a "banking" scheme under which enterprises can defer payment of the charges in exchange for making larger reductions in emissions or paying higher emission charges in future. There must be a limit on the amount that can be "borrowed" in this way, so that the length of time allowed for "paying back" the deferred sum of pollution charges must be rather short—no more than 4 years. This arrangement reflects the reality that the government is likely to be unwilling in the short run to bankrupt heavy polluters which are unable to pay their pollution charges. However, it will be credible only if the authorities take steps to make clear that enterprises which fail to "repay their loans" will be closed down in future. One way of doing this might be to take out a lien on the property and other assets of privatized enterprises which defer payment, so that their new owners cannot evade the charges by asset-stripping.

No system of pollution charges or other economic instruments can change the underlying political choices. If governments give priority to maintaining production and employment, then environmental policies which threaten

Box 3.5 Financing Environmental Protection in the Russian Federation

In the last three years, the Russian Federation has been establishing a system for financing environmental improvements which does not rely upon transfers from the government budget. Ecological Funds have been set up at federal, provincial (oblast), and local levels to channel resources to programs of environmental protection, nature conservation, scientific studies, technological development and compensation for the health damage caused by pollution.

These Funds rely primarily upon the revenue generated by pollution charges (both fees and fines), waste disposal fees, and other payments made to compensate for the environmental consequences of past actions by enterprises and other organizations. They are empowered to invest in the development of environmentally-sound technologies or in enterprises with appropriate environmental objectives.

The Ecological Funds were expected to receive at least 80–90 billion rubles from pollution charges in 1993—equivalent to US$85 million at an exchange rate of US$1 = 1,000 rubles. This revenue should rise rapidly as pollution charges are increased in real terms, though the decline in the output of heavy industries such as metallurgy and chemicals will reduce the sums received by the Funds.

The government is also negotiating a loan of US$50 million from the World Bank to establish a National Pollution Abatement Fund which would finance the foreign exchange cost of projects to reduce losses of raw materials and intermediate products or recover valuable materials from waste streams. Finance will be provided in the form of loans which must be repaid in foreign currency and which will bear a commercial rate of interest.

these goals will be set aside in one way or another. *Adopting policies which are not enforced will just undermine the credibility of the environmental authorities and of the government in general.* Thus, the transitional arrangements that are implemented must reflect the authorities' willingness to follow through on difficult cases in order to achieve their environmental goals. It is *better to accept a lengthy transitional period* than to set targets which few believe or are able to meet, since deadlines that are always postponed are much worse than longer deadlines that are regarded as being firm.

Financing environmental expenditures

In all market economies, the bulk of environmental investments are financed by enterprises out of their own resources.[7] Environmental expenditures must compete with other claims on investment budgets, so enterprises have a substantial incentive to improve their operating practices or to find other methods of reducing the costs of meeting their environmental obligations. In Central and Eastern Europe, however, the philosophy has become deeply ingrained that improvements in environmental performance depend upon new investment, even though much can be achieved at little or no cost by "good housekeeping," better maintenance, simple improvements in process controls and similar measures.

Both economic and environmental considerations dictate that environmental policies should focus on achieving the maximum environmental benefits from the removal of energy and other subsidies and from other opportunities to implement "win-win" measures. This will encourage enterprises to look beyond investment in end-of-pipe controls as the primary method of reducing emissions and will accustom them to the need to assess environmental expenditures on a par with other investments or operating expenses. The government's role in financing such expenditures should, as far as possible, be limited to the provision of loan finance on quasi-commercial terms. Strictly, this should not be necessary if appropriate incentives—higher energy prices, pollution charges, etc.—are correct. However, the financial state of the banking system may be such that it is unwilling to make medium term loans to enterprises, especially those which have not been privatized, so that government lending or government guarantees may be necessary to fill the gap in the range of loan instruments.

Most countries in Central and Eastern Europe have established Environment Funds to receive and disburse revenues from pollution charges and other sources. In the short run these offer a mechanism for relaxing the tight budgetary constraints on government spending. They are also a way of lessening opposition to raising pollution charges if enterprises see that revenue raised from such charges is being used to finance environmental expenditures. Unfortunately, both of these aspects have their disadvantages in the longer run. Off-budget funds which receive tied revenues such as road funds financed by gasoline taxes have a very mixed record around the world. They tend to distort government spending decisions and, if they become widespread, they can narrow the scope for fiscal policy to an unacceptable degree. Spending for environmental purposes must eventually be evaluated on an equal footing with other budgetary programs and justified by reference to the benefits that are generated relative to the cost of raising revenue or of not spending it to meet other objectives.

Viewing pollution charges as a mechanism for financing environmental spending has other disadvantages. Their main purpose is to ensure that enterprises and others bear the cost of environmental damage that they impose on the general community. If effective, polluters will change their behavior to reduce emissions and, therefore, revenues. Funds which see their role as financing specific types of investment have a tendency to become self-perpetuating bureaucracies and they are likely to set charges at a level that is too low in order to maximize revenues *over the longer term.* Thus, Environment Funds should be established with a limited mandate which ensures that their performance is reviewed at regular intervals and that they cease to operate after a period of, perhaps, 10 years. Their operational

Box 3.6 National Environmental Funds

The National Environment Funds in Bulgaria, the Czech Republic, Hungary, Poland, and the Slovak Republic together total more than US$600 million derived from environmental fees, taxes and fines

Key Features	*Bulgaria*	*Czech Republic*	*Hungary*	*Poland*	*Slovak Republic*
In full operation since	*1993*	*1991*	*1993*	*1989*	*1991*
Sources of Income:					
• Fees, fines	x	x	x	x	x
• State budget	x	x	x		x
• Fuel tax			x		
• Revenues			x	x	
Types of Disbursements:					
• Grants	x	x	x	x	x
• Low-interest loans	x	x	x	x	x
• Guarantees			x		
• Portfolio investments				x	
1993 budget (US$ million)	7	100	45	440	40

Source: The Regional Environmental Center

arrangements must take account of the fact that they control public monies and should, therefore, be subject to the standard rules of public spending covering accountability, management and transparency.

The role of Environment Funds in relation to general environmental policies must also be carefully defined. In general, the disbursement of money from such funds should be linked to implementation of the priorities and measures identified in a National (or Regional) Environmental Action Plan. If this is not done, there is a danger that a Fund may undermine the consistency and effectiveness of environmental policy by pursuing its own objectives which will probably be shaped by the ease of disbursing funds for investment.

Environmental standards

There are three kinds of environmental standards which serve quite different purposes in environmental policy:

- *Ambient standards* set maximum levels of a pollutant in the receiving medium (air, water and soil).
- *Emission standards*[8] set maximum amounts of a pollutant that may be given off by a plant or machine.
- *New Source Performance Standards* (NSPS) are specific emission standards—always based on the Best Available Control Technology(BACT)—in which the emission standard is only applied to new plants.

Annex 5 provides more detail on the role of these different types of environmental standards.

The first two kinds of standard are often linked. In many regulatory systems, a plant that wants an emission permit may have to show that emissions will not raise typical concentrations above the level prescribed by the ambient standard.

Ambient standards for air quality in most Central and Eastern European countries are considerably stricter than EU ambient standards, and the number of pollutants for which ambient standards have been promulgated tends to be greater than is common in EU/OECD countries. But such strict standards may be counterproductive. Given the limited resources for monitoring, it is difficult or impossible to track all of these pollutants. For all environmental media, it would be *better to adopt a simpler set of ambient standards* which reflect current analytical capacity. This capacity will increase over time, so that ambient standards for other pollutants could be temporarily suspended rather than repealed.

Countries in the region may decide to adopt stricter standards, for example ones equivalent to those applied to new sources in the European Union today on the grounds that this will accelerate the rate of decline in emissions from the most heavily polluting industries. However, there is a familiar dilemma in following this approach. If there are significant costs involved in meeting the stricter standards, then applying them only to new plants will have the effect that enterprises will prefer to keep older plants operating longer so as not to have to make the large investments in new equipment. The result, at least in the medium term, may be higher costs and higher pollution. One way of resolving this dilemma is to require that all plants should meet the stricter standard by the end of a transitional period. This is the approach that is followed by European Union directives with transitional periods that may be as long as 15 years. It involves greater expenditure on environmental controls but ensures that there can be no long term disparity between the environmental performance of old and new sources.[9] The impact of applying EU new source emission standards either to new sources alone or to all sources by 2010 is illustrated in various of the scenarios described in **Annex 3**.

It is crucial to set realistic target dates for the implementation of stricter emission standards. Several CEE countries have proposed or adopted emission standards that are based on either EU or German precedents. **Box 3.7** shows that the EU framework of standards is much more complex than is usually understood. In several cases—for example, the Czech Republic and Poland—the period allowed for the implementation of equivalent standards is less than 10 years and may be as little as 5 years. While the reasons for seeking better environmental performance are understandable in the context of long term goals of joining the EU, experience in Western Europe suggests that such implementation periods are much too short. Industries in Western Europe have had several decades to adapt and even now there are many plants which have difficulty in meeting current emission standards. Lengthy adjustment periods (of up to 25 years) have been provided for new

Box 3.7 Environmental standards in the European Union

The EU framework of environmental standards is more than simply a set of specifications of ambient and emission limits. It involves targets (some of which are not numerical) which need to be converted to workable objectives to be implemented over specified periods. To the extent the EU has established specific standards, these are usually associated with a lengthy phasing-in period with intermediate targets. In other words, the EU framework is as much a process as a product. In most EU countries, this process was initiated in the early 1970s, and it has taken 20 years to achieve compliance with some intermediate targets.

There are few EU emission standards and those that exist are subject to exemptions. For example, lignite-fired plants may exceed emission limits if it is determined that lignite is an essential fuel and implementation of controls would entail excessive costs. Such a provision, applied in CEE, would allow some of the lignite-fired power stations in the region to continue operating. A more important exemption is contained in the directive dealing with emissions from industrial plants. This recommends the adoption of BACT provided that this does not entail excessive economic costs. Some of the richest EU member countries have developed their own ambitious sets of emissions and ambient standards that allow no such exemptions.

Countries in Central and Eastern Europe which seek to meet EU standards could embark on the process of adopting the framework now. The main issue then is to determine realistic and appropriate intermediate targets. One of the principal benefits of adopting the framework of EU standards is that it could replace many existing standards, which are mostly too strict to be enforceable.

member states of the EU to come into conformity with EU emission standards and even then it is likely that derogations from certain standards—especially on water quality—will need to be granted.[10]

Enforcement

In the past, enforcement was regarded as a marginal activity. Those responsible for it often found themselves advising enterprises how to avoid fines or other penalties rather than insisting that environmental legislation be properly implemented. But investors (especially foreign investors) set great store by a predictable regulatory regime with evenhanded enforcement of national and local standards. Environmental policy makers should, therefore, regard the question of enforcement as a central one. Without adequate provisions for consistent enforcement, new legislation is not credible and may be seen as unfairly putting those who choose to comply at a disadvantage.[11]

To minimize costs of monitoring and enforcement, it is important to rely upon self-monitoring by enterprises combined with sufficient random checks to ensure that enterprises operate their monitoring systems properly. Quite apart from the cost advantages of self-monitoring, it is an important mechanism for enhancing environmental awareness among the senior managers and other staff. Internalizing environmental concerns in this manner will reinforce the philosophy that enterprises should, wherever possible, attempt to avoid causing environmental damage rather than leaving matters until they are obliged to take action by external intervention. Requiring that information on air and water pollution emissions be made public can also serve as a powerful incentive to comply with environmental rules.

Reliance upon self-monitoring will only be possible if enterprises and other pollution sources have had some influence in the process by which environmental objectives are set, regulations are drafted and other instruments are introduced. This does not mean that they should have a veto over such policies but it recognizes the reality that governments cannot enforce policies which are widely perceived to be infeasible, inequitable or ill-conceived by those whom the policies affect. At best, the outcome will be formal compliance that is effectively undermined by the exploitation of loopholes or other ways to subvert the goals of the policies.

Recognizing this, the process of enhancing environmental performance in most OECD countries has relied heavily upon negotiated agreements between the environmental authorities, specific industries and other interested parties. These agreements are "voluntary" in the sense that those affected had the option to refuse to participate, but at the risk that the authorities might have imposed stricter requirements on them. For the authorities, the advantage of such agreements is that (a) they reduce the costs of monitoring and enforcement which can be partly undertaken by industry bodies, and (b) the overall cost of controlling emissions may be reduced by treating an industry implicitly as a bubble, with enterprises achieving different emission targets reflecting their control options and relative costs. Peer pressure within the industry can then be quite effective in ensuring and monitoring compliance with the agreement.

Notes

1. If old capital equipment were scrapped at rates typical of market economies, less than one-half of the existing stock would still be operating in its present manner after 10 years.

2. Average energy prices in Hungary are now at or above West European prices. Industrial prices for coal, oil and gas in Bulgaria, the Czech Republic, Poland, Romania and Slovakia are at or close to import or export parity prices. After falling during the early months of 1992, the real prices of coal, oil and (most recently) gas for industrial users in most states of the former Soviet Union have risen substantially above their pre-reform levels. Electricity and heat prices have tended to lag behind other energy prices, as have household prices for coal and gas. However, these account for less than 30 percent of total energy consumption in most countries, so that the overall picture is one of substantial progress in raising energy prices to market levels, thereby encouraging greater efficiency in the use of energy.

3. *Scenario 1* refers to the likely outcome if only new installations in CEE are equipped with Western European technology prevailing today.

4. Bollen, J., J.-P. Hettelingh and R. Maas, *Scenarios for Economy and Environment in Central and Eastern Europe.* RIVM (National Institute for Public Health and Environmental Protection), Bilthoven, The Netherlands, 1994.

5. Hughes, Gordon, *Economic Reform, Industrial Restructuring and the Environment* (Washington, DC: The World Bank, 1994).

6. The OECD's *Guidelines on the use of economic instruments in environmental policy* together with a number of related publications on Western experience of the application of economic instruments provide valuable guidance on how pollution charges, tradeable permits and similar instruments might be introduced.

7. In the United States, over 60% of the cost of protecting the environment is paid by private facilities to comply with environmental standards. Local governments assess taxes and user fees to finance an additional 20% of the cost. The remaining expenses are paid by state and federal agencies and are also raised through taxes, user fees, and alternative financing sources such as revolving funds.

8. In some CEE countries, the term "emission limits" is used, to indicate that the emission standards are only in reference to physical emissions from the plant, regardless of the technology used. In contrast, Western emission standards often imply the requirement of a type of technology.

9. The process of phased, negotiated compliance at the local level is further elaborated in chapter IV.

10. It is interesting to compare current environmental conditions in Central and Eastern Europe with those prevailing in the West 10–20 years ago. For example, a comparison of the Elbe (former German Democratic Republic) and the Rhein shows that concentrations of key pollutants were roughly the same in 1988 in the Elbe as they were in 1970 in the Rhein.

11. In the late 1960s, France experimented with a law that required zero discharge and imposed severe penalties for violations. The law was universally viewed as unreasonable and so was never enforced. Less control was accomplished under this law than would have been accomplished with a less stringent law that could have been enforced.

Chapter Four

Building Better Institutions

Chapter Contents

Experience in Western countries shows that successful environmental policy requires the explicit commitment of the whole government, and an open approach to setting priorities and making choices.

The greatest contribution to improved environmental management is likely to come from strengthening local and regional institutions within countries—in particular, improving their capacity for economic and financial analysis. National environmental authorities should place more emphasis on policy coordination. Substantial savings are possible by making environmental decisions at the level of river basins or air sheds.

Studies for project preparation and industrial reviews need to be re-thought. They should focus on those areas where scarce investment resources can provide the greatest benefits rather than offering pre-packaged recommendations based on conventional Western technologies. Substantial local participation is essential. The terms of reference for studies need to be drawn up to ensure that the resulting proposals meet clear objectives and take account of financial and institutional constraints.

A Commitment to the Environment

The success of environmental policies depends on the explicit commitment of the entire government backed up by the electorate. But popular commitment, although vital, is not enough. The quality of institutions is an equally important aspect of environmental policy. Without sound institutions, good intentions will never be translated into reality.

A country's environmental performance is not principally determined by decrees from its environmental authority. Rather, the environmental authority mediates, facilitates, and leads by persuasion.[1] In industry, better management alone would solve many of the most serious environmental problems. But the CEE countries are handicapped by an imbalance between high technical expertise and relatively weak management capabilities in their environmental institutions, a situation that is aggravated by the general lack of incentives for highly qualified individuals in government. These are problems to which there are no easy solutions.

Legislative and institutional reform

Environmental legislation

In the past, all Central and Eastern European countries had developed stringent, but not enforceable environmental legislation. In many of these countries, the new governments face a problem. Some of the legal environmental requirements, especially the existing ambient standards for water and air pollution, are unrealistically strict. However, to downgrade them would cast a better light on the environmental performance of the former communist governments.

While the CEE countries are reluctant to soften their environmental standards, most of them do want to redesign the system of environmental management, and often see the starting point as the passage of comprehensive environmental laws. These laws would set the institutional, regulatory and executive framework. In most cases the key legal innovations include defining the status and the functions of the central environmental agencies (Ministries of Environment or their equivalents) and the local

Box 4.1 Key features of National Environmental Action Plans

In October 1993, the Government of Canada hosted a meeting organized by OECD to review experience gained throughout the world with the development and implementation of longer-term environmental plans. Much of this experience is relevant to the preparation of National Environmental Action Plans in Central and Eastern Europe.

The following were among the major conclusions of the workshop:

- There exists no unique model for a country-based NEAP. Each case must be tailored to the particular situation.
- Emphasis should be more on the process of working out a strategy or a plan rather than a plan for its own sake. The process has a value in itself.
- A good starting point is to determine and improve the information base.
- *Undue speed to produce a document* as a product rather than as a vehicle for achieving more fundamental objectives, would rather frustrate the process and prevent it from being really country-driven.
- National planning for sustainable development should be seen as flexible in substance, responding to changing needs, and in format.
- Major stakeholders in the society must participate both in the design and the implementation of the plan.
- Determination and perseverance of officials as well as the commitment and leadership of politicians are essential for success.
- A strong monitoring-of-performance capacity should be developed.
- Clear performance goals and (if possible) quantitative targets should be established.

environmental authorities; introducing the polluter-pays-principle; designing specific policy instruments; instituting environmental impact assessments; and opening access to environmental information.

The social and economic upheavals in the CEE countries impose two constraints on the effectiveness of these comprehensive laws. The more ambitious they are, and the tougher the standards they set, the greater the danger that the turbulence of transition may make it difficult to implement them. If, on the other hand, they are written in a flexible manner, their implementation requires a series of Ministerial Ordinances or Regulations to specify the general definitions. But continuity in the policy process is vulnerable to changes in government. As a result, enforcement is undermined.

Besides, *when comprehensive environmental laws exist, legislators become less interested in integrating environmental concerns in the economic reform laws.* A shortage of qualified environmental specialists and lawyers, and a lack of tradition of transparent legal processes may lead to the introduction of key economic reform laws with little or no consideration of environmental issues.

CEE countries have an opportunity to learn from mistakes in OECD countries and to develop more responsive institutions. In practice, this means above all strengthening the integration of sectoral and environmental institutions responsible for industrial development and energy on one hand, and agriculture and forestry, land privatization, tourism, and transport on the other hand. Environmental agencies should avoid becoming over-extended and instead focus their attention on a limited set of objectives that can have a significant impact on the policies implemented by the sectoral ministries.

Institutional adjustments

In all CEE countries, environmental institutions need reform. The top priorities for institutional changes should be: (i) shifting responsibilities for environmental management from central to local authorities; (ii) increasing coordination among ministries on environmental issues; and (iii) improving the functional capacity of the environmental ministries.

DECENTRALIZATION OF ENVIRONMENTAL MANAGEMENT. At present, local and regional agencies in CEE countries are primarily responsible for implementation, monitoring, and enforcement, while national authorities are responsible for coordinating and setting overall environmental policy and objectives. Regional institutions are also sometimes charged with environmental management which goes beyond local political boundaries, as is the case, for example, with River Basin Boards in Poland.

Decentralization is a mixed blessing for environmental policy. Local governments throughout the region are acquiring administrative responsibilities from central governments, usually without adequate powers to raise revenue. As central funding has been drastically reduced, most local authorities are now dependent on the limited funds that they can raise locally. At the same time, they have little power to levy their own taxes. In order to compensate for the shortfall in revenues, one result can sometimes be unrestrained exploitation of natural resources, especially of those found in protected areas which are relatively unexploited. For example, there is a growing number of instances, notably in Russia, where logging restrictions have been waived over forests both within and outside protected areas.

Such exploitation is aggravated by the rejection of the concept of planning which is perceived as synonymous with centrally planned economies and therefore anathema to land use strategy. Consequently, development masterplans are drawn up that often ignore any previous concept of planned control. Instead, they seek to maximize what potential the locality may offer, in order to raise living conditions and maintain an already frayed infrastructure.

Another consequence of decentralization is the threat of policy fragmentation. In Hungary, for example, the adoption of a decentralization law doubled the number of municipalities to 3,200. As a result, the average size and population of municipalities is tiny. This miniaturization often makes it impossible to take environmental actions on the required scale, which is generally larger than the territory of the municipality. Since all connections between regions used to formerly be directed through the central government, it is now hard to create joint pro-

grams and implement appropriate environmental management functions. As a consequence, scarce resources are used in a less efficient way, without proper coordination between neighboring regions.

CEE countries need to create strong local arms for national environmental agencies. In particular, they need to create or strengthen the institutions which manage river basins. Many CEE countries have expressed an intent to establish river basin management authorities; in some countries, these have existed for some time but need to be strengthened. Financing mechanisms and channels have to be developed, and the responsibility for standard-setting established. Authorities should ensure—in collaboration with municipalities—that necessary recurrent costs can be met from, among other things, user fees and pollution charges. The French system of river basin agencies may provide some interesting lessons to CEE countries developing their own systems (**Box 4.2**).

Large-scale investments should await the establishment of well functioning river basin authorities which can make sound decisions on the best ways to improve water distribution and quality. Where the development of these institutions is delayed, any proposal for substantial investments in the water sector should, at the very least, be evaluated by experts with a brief to examine the implications of the proposal for the river basin. As the example of the Nitra River suggests (**Box 4.5**), a system-wide analysis of priorities with regard to wastewater management alone has the potential for reducing costs by 80 percent.

INCREASING INTER-MINISTERIAL COORDINATION ON ENVIRONMENT. Effective environmental policy requires commitment to coordinated actions between economic and sectoral ministries. Most of the countries of Central and Eastern Europe have recognized the value of separating regulatory responsibilities for natural resource management from resource exploitation (*e.g.*, by placing regulatory responsibilities in a ministry of environment rather than, say the ministry of agriculture or forestry). However, the central environmental ministries and agencies in Central and Eastern Europe have tended to be ignored by other central authorities. As a result, macroeconomic goals and policies are set with little or no consideration for their potential environmental impact. It is best to create formal mechanisms for cooperation between the environmental agencies and other ministries and agencies. (For example, the U.K. has created a "Green Ministers" Cabinet Committee.)

STRENGTHENING ENVIRONMENT MINISTRIES. Environment ministries need an organizational structure which emphasizes policy and coordination, rather than implementation (which is better left to regional and local institutions). One technique is to create a senior position to deal with policy issues. Some western countries are devising an approach to environmental management which considers the effects on all media (air, water, wastes, etc.). In the Netherlands, for instance, the Ministry of Environment has created two sets of staff teams; one organized around clusters of issues (acidification, chemical hazards) and the other around target groups (refineries, farmers, builders). It is also important to build a close working relationship with ministries of health, many of which traditionally have been responsible for ambient environmental monitoring. Such a relationship should help to establish the vital link between health objectives and environmental policies and investments.

The following institutional improvements are desirable:

- Create a First Deputy Minister (or equivalent senior) position for Environmental Policy and Regulations to shift attention from technical to economic policy issues, and from day-to-day control to strategy development and policy implementation.
- Design task oriented (rather than sector oriented) teams under the new Deputy, to connect existing departments and to provide links between ministries.
- Create positions for financial analysts and econo-

Box 4.2 The French River Basin Agencies: An Example of Regional Water Management

There has recently been an important change in the system of water rights in France. A law of 3 January 1992 considers water as a common heritage and thus closely associates the users of the country's six river basins in its management. It is based on an integrated approach with a dual objective: satisfaction of user needs and conservation of the natural environment.

The central Ministry of Environment establishes basic water policy, lays down regulations and organizes overall planning in consultation with, and assisted by, the Interministerial Water Council. Specific aspects of water management are entrusted to technical ministries. The "Prefets," aided by territorial public services, are responsible for local control of water and fishing. They authorize uses and discharges, apply legislation specific to pollution or dangerous installations, enforce compliance with ambient water quality standards and approve project design documents related to water and fishing.

Overall coordination at the level of a large river basin is provided by the Basin Committee and approved by the national authorities. The Basin Committee organizes meetings of users, local authorities and central government. It defines the policy and management of the catchment area. It evaluates and judges the charges and programs suggested by its executive agency, the Water Agency. Since 1967, each of the six main river basins of the country has its own Water Agency.

The Water Agencies raise the money to support projects to clean up domestic, industrial and agricultural pollution through levies collected from users in proportion to the quantity of water abstracted or consumed, and/or the amount of pollution discharged. The levies are fixed by each Agency in accordance with priorities decided in each catchment area and after consultation with the Basin Committee. They are redistributed to local councils, enterprises and farmers to support investments in water conservation and protection. The Water Agencies do not act as project managers for such investments.

Each Agency implements a five-year plan which defines priorities, determines the nature of the work to be carried out, and identifies the amount of financing required. Agencies also collect data on water quality and on human activity in the catchment area, land use, and other environmental parameters. The Agencies also contribute to research on various environmental issues.

mists to develop new mechanisms for environmental financing that do not require scarce central government management resources and that could build, for example, on financial and human resources that are becoming available in the reforming banking sector.[2]

- Develop carefully monitored programs for CEE local and ministerial officials to spend time working side-by-side with colleagues in Western institutions[3], and for mid-level officials and business executives from Western institutions to work in CEE ministries and regional offices.
- Set up cabinet-level committees for environment and development, bringing together the ministries of environment with economic and sectoral ministries.
- Establish temporary task forces of high-level officials to prepare the work for these cabinet-level committees, and provide career and other professional incentives to encourage participation.
- Designate staff from the ministry of environment to participate in strategy development in sectoral ministries, and invite staff from those ministries to Working Groups in the ministry of environment on relevant issues.
- Within the ministry of environment, create capacity for evaluating policies (especially those that affect industry, agriculture and infrastructure) and set long-term targets for key environmental indicators.

Environmental monitoring and information systems

Environmental information and the transition process. A substantial amount of environmental information is available in many of the CEE countries. However, much of it is scattered, is of variable quality and accuracy, was collected for differing purposes and is often not comprehensive in coverage or historical record. At the same time, the transition to democratic, market-based societies is fundamentally altering public and private sector expectations of, and demands for, such information.

Environmental information is needed to set priorities; to monitor and enforce compliance with regulations; to integrate policy; and to inform decision-makers, the public, the private sector, NGOs and interest groups.

The challenge is to redesign existing systems, upgrading the quality of existing arrangements where necessary, discarding activities which do not meet users' needs or which are not cost-effective, and progressively filling in the most important gaps. One priority should be to strengthen the availability of quality information in those areas with the greatest risks to human health and of irreversible environmental change. Another priority is to ensure that reliable environmental information is available for foreign and domestic investors on issues such as the environmental conditions at and around sites where hazardous substances have been used or discharged.

TECHNICAL DESIGN OF INFORMATION SYSTEMS. Once the framework of the environmental information system has been established, attention should focus on the methods used to collect data. In many CEE countries, much of the environmental data come from questionnaires and calculations based on the characteristics of production processes. For example, in Poland 90% of environmental data is collected this way, and only 10% by monitoring. Monitoring networks need to be extended in ways that ensure the compatibility, comparability and reliability of the data collected. The tendency for state-of-the-art technology to "drive" the system should be resisted—equipment should be procured strictly to fill the information needs which, in turn, should derive from clearly established policy priorities. Statistical methods will continue to be important and, in those cases, sample surveys should replace more costly census methods.

After years of relative isolation, CEE countries need to strengthen the links between their environmental information systems and international arrangements. The need for objective, comparable information at the European regional level underlies the request by Environment Ministers at Dobris for the first pan-European report on the state of the environment. Some steps have been taken to link national and international systems, *e.g.* UNEP/GEMS and UNEP/GRID, as well as UNEP/IRPTC. In the framework of regional agreements such as the Baltic Sea Helsinki Convention, some upgrading and harmonization of monitoring systems has been achieved. Work with international organizations like GEMS, GRID, UN/ECE, Eurostat and OECD has helped improve the comparability of environmental information. These efforts should continue and should receive further impetus from the establishment of the European Environment Agency.

As the role of the state has shifted from architect to regulator of economic activity, the main responsibility for producing environmental information in CEE countries has shifted from central statistical offices to environment ministries. This has important implications for environmental information systems: the objectives they serve, how information flows and to whom, the methods which are used. Environment ministries must now coordinate flows of information throughout and beyond government, to reach the new users of environmental information. This will mean working with other government departments—especially ministries of health which have traditionally collected data on ambient environmental quality—and with the private sector and NGOs. They must also improve the flows of information between the central and local/regional levels of government.

DIFFUSION OF ENVIRONMENTAL INFORMATION. One of the most powerful forces for environmental improvement in OECD countries over the last 20 years has been increased public awareness and pressure. This contrasts starkly with the situation in CEE where information on environmental conditions was often a state secret. When data was disseminated publicly, it was sometimes distorted and falsified.

It is therefore crucial to improve the diffusion of environmental information. In practical terms this may mean producing regular *state of the environment* reports; developing environmental indicators; using multi-media communication techniques to reach a wide audience range; preparing "user friendly," summary-type brochures on specific resources and their management; promoting

information-sharing arrangements with key groups, such as professional bodies, business, NGOs and labor unions; and providing environmental information/fact sheets targeted, for example, on specific regions, investors or managers in different industrial sectors.[4] Given the lack of experience with such approaches in CEE, this is an area where Western assistance would be particularly useful.

POLLUTION MONITORING AND ENFORCEMENT. All of the countries of Central and Eastern Europe have fairly extensive monitoring systems with usually hundreds of ambient air and water quality monitoring stations in each country. However, their operation is sometimes inefficient since measurements are not always taken regularly or systematically, and monitoring is often carried out by different government agencies and scientific research institutes and unevenly coordinated. At many monitoring sites for air and water pollution, equipment is either not operating, is poorly maintained, or is being operated by people with inadequate training. Calibration of existing monitoring equipment is also poor, and the use of some manual equipment further compromises the consistency and reliability of monitoring data.

Much can be achieved by promoting self-monitoring of *continuing compliance*[5] by enterprises, with random spot-checks by the authorities. As part of this process, the linkage between monitoring and enforcement can be tightened. One way that has been recommended in several countries involves *making the future frequency of monitoring or spot-checks depend on the past record of compliance* (*e.g.*, sources found in violation twice in a row could be put on a watch list for frequent audits). With appropriate penalties for violations, it has been demonstrated that high rates of compliance are possible even with tight budgets.

In deciding on the number of monitoring sites and stations, priority should be given to areas with the highest ambient levels of pollutants which damage human health. It is better to have fewer but effective monitoring stations than many poorly operating ones. This is especially true since these monitoring stations will be collecting the information upon which future environmental policy, planning, and management decisions are based. Successful implementation of pollution charges and fines is predicated upon accurate information and sound monitoring, and eventually reaching agreements on transboundary pollution issues in the region will also depend on more reliable monitoring.

Constraints on policy and project implementation

The legacy of central planning

Abandoning central planning has proven to be much easier than learning to identify, prepare, appraise and implement policies in a decentralized but sound manner. For many officials in Central and Eastern Europe, the routine of centrally controlled resource allocation is so entrenched, that ministries often continue to design investment programs in the hope of obtaining financial support from the West. In some cases, Western donors have tended to reinforce old habits. CEE countries are now discovering that after several years of "studies," financing for tangible projects has fallen far short of expectations. This is generating increased skepticism about the value of such studies in both donor and CEE countries.

Part of the problem is that donors do not understand how the influence of central planning carries over to today, and CEE authorities have difficulty comprehending arcane aspects of financing and procurement common in the West. **Box 4.3** provides a synopsis of the investment cycle under central planning. It highlights the fact that decisions on resource allocation tended to be subjective and politically motivated, and took little notice of efficiency and performance quality.[6]

Because of the "soft budget" approach and the scarcity of equipment and materials, the investment pattern was characterized by: (i) easy access to finance; (ii) rapid project design (with few studies, typically amounting to less than 5% of project costs); and (iii) slow implementation. Implementation delays often led to a situation in which incomplete projects were prematurely put into operation. Subsequent deficiencies in operation and maintenance resulted in proposals for new capital investments as the only solution to the accumulated problems. Frequently, it used to be easier to launch a new capital investment cycle than to improve the performance of what already existed.

SIGNIFICANCE FOR CURRENT PRACTICES. The legacy of past practices influences current investment behavior in three ways. *First*, polluters frequently oppose actions except in cases of emergency.[7] *Second*, they prefer investment-intensive solutions to low-cost improvements such as better housekeeping. *Third*, the tradition of centralized investment decision-making on a case-by-case basis (instead of within a broader national or local strategy) slows down the transition of responsibilities from the government to the business community.

The Western approach

In contrast, the typical Western approach involves a series of incremental steps over a relatively long period. Often, 20% or more of total project costs are spent on project identification, preparation, design and appraisal. In the case of an industrial enterprise, the process might work as follows:

- review of plant operating procedures and management practices, and/or diagnostic environmental audit to determine the immediate priorities;
- "zero-cost" improvements involving management, maintenance, and "housekeeping" modifications;
- concurrently, small capital improvements, intended, for example, to make a product using fewer or less toxic raw materials, or to redesign equipment so that the waste can be re-used;
- at the same time, a detailed environmental audit, examining long-term targets, including projection of likely changes in laws and regulations;
- detailed design study of technological improvements involving control and process changes;

Box 4.3 The Project Cycle under Central Planning

Identification. The first phase in the investment process consisted of proving that action was economically feasible and consistent with the planning priorities. Although the proposals typically originated with a municipality or an enterprise, the project proposals went back and forth between four key governmental institutions—the Planning Committee, the sectoral ministry, the Ministry of Finance, and the Ministerial Council—before it was approved.

Design. This phase tended to be short. All parties—the municipality, the sectoral ministry, and the design company—were equally keen to proceed quickly once the construction project had been approved.

Typically, only 4-5% of total investment costs were allocated to complete the physical design work. This was considered enough even when specific technical or geological problems arose. The specialists undertaking the design work were normally not expected to carry out broader analyses involving a determination of least-cost solutions, changes in scale, etc. Outside consultants were used only on rare occasions. The "economic" analysis tended to be confined to a simple financial statement of construction materials and equipment. Once the design was completed, the product had to be approved by an investment control office, and by representatives of the municipality.

Implementation. Although financing was available, projects frequently could not proceed because of shortages of construction materials, qualified labor, necessary equipment, and supporting infrastructure. The consequences were as follows:

- the initial time schedule had to be revised, and a new starting date requested;
- the construction process proceeded in spurts—different tasks were carried out according to the availability of material and equipment (often necessitating design changes);
- changing government priorities resulted in a gradual reallocation of funding towards other projects, and the amount of funding available fell short of the required amount;
- frequent postponements did serious harm to project quality. Often, the project began operation before construction was finished. Temporary solutions tended to become permanent. As a result, the original plans became outdated, and part of the completed works needed repairs;
- because they worked badly, projects could not generate sufficient revenues to pay for operation, repair and maintenance. They were therefore chronically short of money—especially if they needed hard currency—and further design changes were often made to avoid the need to procure parts with foreign exchange.

Operation and maintenance—where practiced—was often unable to make up for the problems that had occurred during construction. Sooner or later, the only solution to this accumulation of difficulties would appear to be new investments. It was often easier to start all over again than to improve performance.

- implementation of these investments over a 5–7 year period; and
- extended phasing-in period of the new technology, including staff training and further small-scale investments to fine-tune and optimize the new process technologies.

In the West, "studies" in a broader sense make up a significant and important aspect of the whole process of environmental improvement. They represent a way for planners, managers, and workers to work with each other to identify and solve the problem. They generally lead to innovations which can be justified on economic grounds alone, but which also bring significant environmental benefits.

Local participation

Environmental reviews and consultant studies are meaningless unless they are carried out in close cooperation with the "clients." This is particularly essential in Central and Eastern Europe, where enterprise staff need exposure to new approaches, where local financial resources are especially scarce, and where pre-packaged recommendations based on conventional Western technologies may be quite inappropriate.

Anecdotal evidence suggests that many of the consultant studies that have been carried out in CEE countries have failed to take account of the particular local circumstances, and have been completed with minimal local participation. The nature of international assistance programs has frequently tended to reinforce the old central planning habits, by pushing governments to propose specific projects, at a time when the specific problems were not clearly defined, and it was not clear how they should best be tackled. *A large number of consultant studies in CEE start from the assumption that a particular project should be undertaken without examining possible alternatives that might be more efficient.* Moreover, such studies often ignore the lack of institutional capacity and money which are essential if the project is to be implemented.

Much more emphasis must be placed on the crucial early steps in designing a project. These are as follows:

- from the outset, there should be extensive consultation and agreement with the implementing agencies and the project beneficiaries what environmental problem is to be solved, and why. Policy reforms or structural changes that affect the viability of the proposed project should be clearly specified. A useful first step might be to disseminate a standardized "fact sheet" which presents information that is of particular interest to local stakeholders (**Box 4.4**);
- feasibility studies should be better designed. The terms of reference of such studies should address not only

Box 4.4 Proposed Project Fact Sheet

Title and summary
Objectives ("Problem to be solved")
Partners involved in developing project proposal
Donor (if any)
Implementing agency
Type and amount of financing (financial, consultancy, in-kind)
For technical assistance: roles of international and local consultants, and share of work
Progress to date
Future work
Report on assessment by implementing agency and/or involved parties: name of assessor, and summary of results
Report on assessment by funding institution (if applicable): name of assessor, and summary of results
For studies and technical assistance: steps taken to ensure implementation of recommendations

Source: East West Environment Ltd., *Independent Assessment of Environmental Assistance to Central and Eastern Europe*, April 1993.

the technical case for investment, but also the financial and institutional requirements for implementing the project. International financial institutions could be involved when preparing terms of reference;

- the chosen solution should be the most efficient one (for such an analysis, see for example **Box 4.5** describing wastewater management in the Nitra River Basin), and ideally one that pays for itself (for example, by saving energy);
- greater use should be made of local expertise. This would help to develop local skills, and could provide a better understanding of local circumstances and be more cost-effective than using international experts.[8] To make progress in this direction, some donors will have to face up to the problem of tied aid—more grant money should be made available for qualified local consultants;
- the following points should be determined in advance and in detail: how the project will be implemented, which institutions will be responsible for it, how it will be financed, what legal impediments may exist, and how the project fits into the existing policy framework. All these issues can be dealt with only by the enterprise and/or local government involved, if necessary with help from the central ministries.

Only after these steps have been taken is it meaningful to proceed to technical feasibility studies.

Management capacity, training and education

The countries in Central and Eastern Europe have well developed educational systems and a highly qualified labor force. For several years, environmental education has been incorporated at all teaching levels, from pre-school to university. However, the emphasis has invariably been on technical skills, as opposed to management and policy-making skills, or general public awareness. Many different types of training in environmental management are needed, not only in environment ministries, but also in public and private industry. Programs are also needed to teach the public to become more actively involved in making and implementing environmental policies.

Western donors are providing some financial and logistical support for environmental education, training and collaborative East-West research. The TEMPUS program of the European Commission specifically promotes links between Eastern and Western universities. Educational assistance is available through the Regional Environmental Center in Budapest (**Box 4.6**), and through a US-EPA incentive for developing training courses. UNEP supports Post-Graduate Courses in Environmental Management together with Germany and UNESCO, and a Training Programme in Environmental Management for Industrial Managers from CEE. These initiatives, however, often are not well coordinated either by donors or by recipients.

The specific type of assistance which is most urgently needed will vary according to the circumstances of individual countries. The secondment of CEE country experts to western private and public institutions (and, where appropriate, of western experts to work in Central and Eastern European Environment Ministries) is one particularly effective mechanism, provided the experts are clearly required on return to pass on their experience. Such secondments would be especially useful for cross-sectoral issues, and for designing effective legislation and implementation procedures. Assistance to upgrade economic analysis and other techniques to support decision-making is a priority.

Environmental education and training faces a number of common problems throughout the region:

- public lack of interest, which results in low sales of environmental publications and an absence of media coverage of environmental issues;
- lack of demand for environmental education and training (especially on a university level) because of the relatively low priority given to environmental issues;
- lack of coordination between various ministries dealing with development of environmental education and training and between educational institutions;
- delays in providing curriculum development, teaching materials, textbooks, teacher-training programs, and other essentials;
- resistance to environmental training by those managers and government officials who are not involved directly in environmental management, but who have a strong influence over economic reform (*e.g.* ministry of finance employees, factory managers, municipal authorities); and

Box 4.5 Cost-effective Wastewater Management in a River Basin: The Nitra River in the Slovak Republic

The Nitra is a tributary of the Váh River which enters the Danube downstream of Bratislava. Its catchment area covers about 5,000 km^2 and includes about 600,000 inhabitants. Its length is about 171 km. The overall BOD discharge to the river system is about 10,000 tons/year, of which approximately 70% is of municipal origin. The water quality in the upstream reaches of the river is high. However, there is a gradual downstream deterioration due to municipal and industrial discharges. BOD may exceed 30 mg/l, an extremely high value leading to dissolved oxygen (DO) depletion at times during the summer.

The purpose of this example is to illustrate the cost savings of a regional least-cost policy:

Minimum Discharge Policy. The costs from imposing EU emission standards (BAT) on all municipal plants, corresponding to the minimum-discharge policy, are very high (capital costs US$64.7 million, and annual operation, maintenance and repair costs over US$14 million). Of course, water quality improves markedly (e.g., minimum DO concentration rises to almost 7 mg/l). This result provides an upper bound on costs and water quality improvements.

Regional least-cost strategies designed to meet a uniform ambient standard (see table below). (i) Meeting a minimum ambient DO concentration of 4 mg/l at all monitoring points (the limit for second-class water in many European countries), the least-cost policy has capital costs of US$13.2 million—one fifth that of BAT (a savings of over US$50 million in capital costs). (ii) To achieve a standard of 6 mg/l for dissolved oxygen (limit for first-class water), the least-cost policy implies capital costs of US$25.6 million—almost US$40 million less than the capital costs for BAT. (iii) Finally, if a water-quality goal not deviating more than 20% from the BAT policy is accepted, the investment cost is still about US$23 million lower (the annual OMR costs are also significantly reduced).

Control technologies. The different policies use alternative mixes of the following six municipal wastewater treatment technologies:

M mechanical only;
CM chemically enhanced mechanical;
B biological;
BC biological with the dosage of chemicals;
BCN biological-chemical with de-nitrification.

Dewatering and anaerobic sludge treatment are assumed for sludge treatment for all alternatives. The example assumes that no sewer construction is required due to the satisfactory state of the existing system. A cost summary for the different options is provided in a box in chapter V.

The analysis considers 11 major point sources: 8 municipal and 3 industrial. The municipal sources included contribute approximately 90% of the total municipal BOD load to the river; the industrial source, about 70% of the total industrial load. The remaining loads are considered to be non-controllable sources.

Ambient Water Quality Standard	*Control Policy*	*Capital Cost (US$m)*	*OMR Cost (US$m)*	*DO Min (mg/l)*	*TP Max (mg/l)*	*TN Max (mg/l)*
none	base case	0	0	0.7	1.8	7.8
none	min. discharge (BAT)	64.7	14.4	6.9	0.4	4.1
DO ≥ 4 mg/l	least-cost (i)	13.2	2.8	4.0	1.3	7.3
DO ≥ 6 mg/l	least-cost (ii)	25.6	6.6	6.0	0.7	6.7
DO ≥ 6 mg/l TP ≤ 0.5 mg/l TN ≤ 6 mg/l	least-cost (iii)	41.9	10.2	6.1	0.5	5.8

Symbols: **DO** - Dissolved Oxygen; **TP** - Total Phosphorus content of water; **TN** - Total Nitrogen content of water; **OMR** - Operation, Maintenance and Repair; **BAT** - Best Available Technology; **mg/l** - milligram per liter

• lack of experience in Western practices of managing environmental training and research, which leads to what Western donors see as an inadequate use of available technical and financial assistance, and therefore a reluctance to increase support for these purposes.

In order to promote efficient environmental education and training, the countries in Central and Eastern Europe need to take *four steps*. They should: (i) survey the existing institutions involved in environmental education and training, and decide how to improve their performance; (ii) review and redesign the teaching programs at all levels; (iii) develop teaching techniques tailored to the particular audience; and (iv) evaluate financial needs, available sources of funds, and the management of money.

An educational training program should be developed and implemented for high level decision-makers at national and local levels. It should be designed in two formats—for top-level ministerial and business staff (ministers and deputy ministers, and managers of big enterprises) in a workshop format, and for middle level staff

Box 4.6 The Regional Environmental Center for Central and Eastern Europe (REC)

The REC is an independent, non-profit foundation, established in 1990 by Hungary, the United States, and the Commission of the European Union. Seven additional donor governments have since joined these sponsors: Austria, Canada, Denmark, Finland, Japan, The Netherlands, and Norway. Major activities include grants programs, an information exchange program that provides access to environmental reports and databases, a junior fellowship program, and a REC initiatives program that brings together both Western and Eastern groups to share their experiences in solving key environmental problems. The REC currently has offices in Bratislava, Budapest, Bucharest, Sofia, and Warsaw.

(ministerial, municipal and business experts) in formal training sessions. Particular emphasis should be placed on providing training for enterprise managers in business planning, marketing and management skills. Enterprise managers should, at a minimum, understand the opportunities for combining better financial performance with energy and water conservation.

Environmental training could be incorporated in all technical and financial assistance projects with environmental impact. Elements of environmental education could also be integrated in training programs in a variety of subjects, such as in economics and management; local government and administration; public finance and taxation; privatization programs; and economic restructuring.

Increasing public awareness and commitment to active environmental policy should be an important target of education and training. It requires broad involvement of professional educators, NGOs and the media. The NGOs in Central and Eastern Europe could be assisted in developing core teams for providing leadership, fundraising capacity and logistical support in this area.

Developing new partnerships and involving the private sector

HISTORICAL ROLE OF ENVIRONMENTAL NGOS. In Central and Eastern Europe, nature conservation organizations existed for many years, but did not enjoy the liberty to consider broader environmental issues. In the 1980s, environmental pollution and its effects on human health were increasingly recognized as serious problems. People started to set up independent environmental organizations, initially in Poland and Hungary. In the Soviet Union, the Chernobyl disaster caused a sudden outburst of citizens' initiatives. By the end of the 1980s, most CEE countries had independent environmental organizations, legally or illegally. In several countries, they acted as a focus of opposition to the old regimes. Many environmentalists played a role in the political transition in 1989.

As a consequence, environment was high on the political agenda of the first democratic governments and in several cases, environmentalists became part of the new administrations and/or representative bodies. On the other hand, the traditional nature conservation organizations in most countries suffered from the transition, which deprived them of their privileged status. As economic and social problems increased, environmental organizations found it hard to keep people involved. Moreover, the state of the environment could no longer be used to attack the old system.

THE CURRENT IMPORTANCE OF ENVIRONMENTAL NGOS. Environmental NGOs raise public awareness, stimulate changes in public attitudes and policies, put forward viable alternatives and often implement them to set an example. In CEE, the role of NGOs is even more important than in the West, for the following reasons:

- A strong environmental movement ensures that environmental issues remain on the political agenda;
- the transition period in principle provides a unique opportunity to establish the basis for sustainable development, by avoiding the mistakes of the West. Environmental organizations can play an important role in this regard, drawing in part on the information available to them from colleagues in the West;
- environmental organizations can contribute substantially to strengthening the fabric of society. They can mobilize the population and motivate people to take on special responsibilities.

CONDITIONS FOR A STRONG ENVIRONMENTAL NGO-SECTOR. Authorities and business need to recognize the case for encouraging environmental NGOs to be participants in the public debate about sustainable development and the development of practical policies. NGOs should be invited to the relevant advisory boards, delegations, negotiations, etc. This should not be restricted to pure environmental and nature conservation issues, but extended to all the areas that are related, especially economic questions. Western governments, multinational institutions and western business should involve CEE NGOs in regular discussion about their activities in the region.[9]

In particular, CEE governments should provide full access to environmental information and the right to participate in environmental impact assessments. In the West, countries differ in the extent to which these rights are granted. *Environmental NGOs have proposed* that U.S. legislation and practice be followed with regard to access to information, and Dutch legislation and practice with regard to environmental impact assessment. In principle, this corresponds quite closely to the public disclosure rules of the European Union.

The need for support to environmental NGOs in CEE. Environmental organizations everywhere basically rely on volunteers, but the economic situation in CEE has made voluntary work difficult. In any case, environmental organizations need a professional nucleus and financial resources. They are unlikely, at least in the short term, to build a strong financial base from membership and individual donations. Governments could consider financial

support to such NGOs in order to assist them to play the necessary roles described above (as is being done by some Western governments in their own countries, as well as by the European Union).

In this context, the bilateral and European Union support to institutions like the Regional Environmental Center (REC) or the Dutch Foundation for Environmental Contacts with Central and Eastern Europe should continue. These mechanisms are a good way to support environmental NGOs in the region, and especially those based on open membership. In addition, a number of Western and international NGOs have programs in CEE countries that merit financial support. Western governments could consider directing part of their support to CEE through NGOs in their own countries or organizations in CEE which are run by NGOs.

Involving the private sector

In the long run, the private sector will play the key role in Central and Eastern Europe in determining what kind of environmental conditions will prevail. The volume of production and financial commitment by the private sector is likely to far outstrip that of the public sector within the next 20 years. This trend is being reinforced by the growth of *foreign direct investment.*

Over the years, private industries in OECD countries have found it to be in their own interest to pursue environmentally sound policies. Indeed, some industries pride themselves as being leaders in environmental management. In the same spirit, the International Chamber of Commerce has developed *World Guidelines on the Environment* and the *Business Charter for Sustainable Development.* In Western Europe, the chemical, electricity, natural gas, coal, and petroleum industries have all prepared various codes of conduct. At a conference in Budapest in November, 1991, a set of *Guiding Principles on the Environment, Industry and Investment Decisions in Central and Eastern Europe* was put forward by the European Commission as a basis for further action.

Notes

1. Charles Weiss *et al., Patterns of Environmental Management* (The World Bank, Washington DC: 1995). This report reviews the experience with regard to pollution management in selected OECD countries.

2. Poland is experimenting with innovative mechanisms.

3. Central and local government officials from CEE countries that visit Western countries would be required to agree to remain in their government jobs for at least, say, one year upon returning.

4. A powerful tool used in the United States to raise awareness by enterprises and the public is the so-called *Toxic Release Inventory*: Enterprises are required to publish the types and quantities of the major toxic pollutants they emit. This has led many enterprises to voluntarily reduce the amounts of pollution they emit.

5. *Continuing compliance* is distinguished from *initial compliance.* The latter usually applies to technology standards for which compliance can be inspected before a plant starts operation (see the discussion of New Source Performance Standards in chapter III).

6. In Bulgaria, for example, sharp fluctuations in the structure of environmental capital investments can be observed between 1980 and 1989. The share of air protection investments dropped from almost 29% in 1980 to only 2% in 1985, and then rose to 20% in 1989.

7. There are important exceptions. Quite frequently, enterprise managers understand that selected process changes would be in the financial interest of the firm as well as reduce pollution emissions. However, shortages and constraints on the availability of foreign exchange have prevented them from taking the desired action. If (public or private) enterprises are to be responsible for their operation, they must have equal access to financial resources—whether foreign exchange or domestic finance—as the government.

8. This does not imply that special preference should be given to local consultants. If the latter are to meet international standards, they should, in general, compete with international consultants. On the other hand, governments and enterprises should insist much more on joint activities between international and local consultants, with clear terms of reference based on a strategic approach, and with careful supervision.

9. Participation of NGOs is vital to ensure public knowledge of issues that are of immediate concern—and the possibility to take action where needed. The rights of NGOs should not, however, be confused with the democratic rights of *all individuals* in society, whose interests may not always be represented by NGOs representing a special interest.

Chapter Five

Priorities for Environmental Expenditure[1]

Chapter Contents

While market reforms will eventually take care of a large part of the emissions causing the most serious health and economic damage in the region, public investments will be needed to speed up the process of environmental improvement. This should be complemented by two other categories of expenditures required to make best use of the available resources: (i) Funding to cover the operational, maintenance and repair costs of ***existing*** *public environmental services, especially the treatment of drinking water and sewage, the collection and disposal of municipal waste, and maintaining inventories of and monitoring the disposal of hazardous, toxic and nuclear wastes; and (ii) "win-win" investments which can be justified on economic grounds alone but which bring substantial environmental benefits. Energy conservation, low input and low waste technologies all fall into this category as do expenditures on "good housekeeping" and minor plant improvements which reduce spills, leaks and material use.*

Beyond this, the priority categories for environmental expenditures are:

- ***Immediate investments to address the health problems*** *identified in Chapter II. In areas with poor air quality the initial priorities should be better dust controls for non-ferrous smelters and steel plants and the substitution of gas for coal in district heating plants and households. With regard to water pollution, pre-treatment of industrial wastewater where heavy metals or toxic chemicals threaten the quality of ground or surface waters, and measures to reduce excessive levels of nitrates in rural drinking water supplies are the priorities. For hazardous wastes the priority must be to ensure that leachates from disposal sites do not contaminate ground or surface water sources. Support could be provided to reinforce and accelerate environmental investments by enterprises in response to new environmental policies such as the reduction of saline water discharges by mines, industrial wastewater treatment in pulp, textile and chemical plants, and measures to reduce discharges of toxic materials from chemical and petrochemical plants.*
- *Efficient investments to deal with* ***urgent problems specific to different countries****. These include appropriate wastewater treatment to protect valuable coastal, tourist and ecological resources, the phased completion of incomplete wastewater treatment plants where this will have the most impact on water quality, and programs to prevent irreversible damage to important ecosystems.*
- *Low cost measures to address* ***long term environmental priorities*** *where prompt action can avoid the need to spend much larger sums in future. Phasing out leaded gasoline and reducing vehicle emissions, funding applied research on the conservation of ecosystems, and the development of systems to collect, interpret and disseminate environmental data all fall into this category.*

This chapter focuses on environmental expenditures and investments whose primary purpose is to mitigate the environmental damage caused by past or current practices, though they may bring simultaneous economic or other benefits. Further, it identifies only those expenditures which will address, over a period of 5–7 years, the urgent environmental priorities identified in Chapter II. Other environmental investments will move up the priority ranking later in this decade as the implementation of the Action Programme reduces the damage associated with the most urgent problems. Thus, the exclusion of particular investments or problems from the list of priorities discussed below does not imply that they are unimportant, but rather that they should have lower priority in the allocation of scarce resources.

As discussed in Chapter III, the process of capital renewal associated with industrial restructuring and recovery from economic recession will lead to the replacement of out-dated and polluting technologies by modern industrial processes with much improved environmental performance. Pollution charges and stricter environmental regulations will direct private investment towards more efficient and less polluting technologies. This will, however, take place over a period of 15–20 years because the countries of Central and Eastern Europe cannot afford to replace their capital stock in a much shorter period.

The industrial investments outlined below are intended to mitigate the impact of continuing to rely upon old capital equipment in the intervening period and to bring forward investment in less polluting technologies. Nonetheless, the limited resources available mean that capital renewal will remain the most powerful agent of environmental improvement in the medium and longer run. Effective economic reforms and good economic policies are therefore essential to the health of the environment, as well as of the economy and society.

The industrial sector in Central and Eastern Europe uses technologies and produces a composition of output that were characteristic of the industrial market economies 30 or more years ago. Over the last 20 years the Western countries have invested in *capital deepening*, adopting more energy efficient and less polluting technologies which make better use both of their capital resources and the skills of their work forces. On the other hand, the formerly centrally-planned countries concentrated on *capital widening*, achieving higher levels of output by building more and/or larger plants rather than by improving the level and quality of output from existing plants. New technology was introduced in a discontinuous manner, often by licensing or imitating Western know-how, in the form of new plants. There is little evidence of the continuous growth in factor productivity associated with both learning-by-doing and investment in small-scale enhancements to both physical and human capital that has proved to be the mainspring of economic growth in market economies.

"Win-win" investments and worker training

As concern has grown about the damage to human health caused by industrial emissions, industries have responded by developing plans based on large investments in new technology and sophisticated controls. However, the resources to fund such investments have not been available and it is, in any case, often not clear whether the general economic performance of the industries concerned would warrant the commitment of the capital that is envisaged. It would be better to take a number of smaller and more manageable steps which might make a substantial improvement to the environmental performance of heavily polluting industries, such as the following:

- *Standard "good housekeeping."* Energy and environmental audits can identify a range of managerial and process changes which would reduce energy consumption and emissions at negligible cost. The installation of thermostats and other simple controls can improve combustion efficiency, reduce spills, leaks and waste of raw materials or heat losses. Increasing energy and raw material prices or the imposition of pollution charges provides a strong incentive for managers to consider the financial benefits of such measures and to spend the money on any equipment and training that may be required. These are mostly "win-win" *investments which can be justified on economic and even financial grounds alone*[2] *but which bring substantial environmental benefits;*

- *In-plant improvements of process technology* or to control emissions that can achieve a substantial reduction in the concentration and volume of emissions. Low input and low waste technologies all fall into this category. Good examples are found in the area of industrial wastewater treatment. Simple chemical or biological treatment may allow a much higher proportion of water to be recycled within the plant—reducing the volume of discharges—or may cut down the quantity of suspended solids and organic waste that is discharged into rivers. Recovery techniques can also be applied to solid wastes from metallurgical plants, power stations and mines;

- *End-of-pipe controls with a modest cost.* The standard example of such measures is the installation of better dust filters in metallurgy or metal-working plants to reduce the discharge of metal dusts in flue gases. A range of non-ferrous metal smelters in Central and Eastern Europe are notorious sources of lead, zinc, nickel, cadmium and other metal dusts which damage the health of the population liv-

Box 5.1 Dealing with large, old industrial plants

Whether to invest in pollution control in the large old industrial "dinosaurs" depends on economic factors. The choices are (i) to close down such plants as rapidly as possible; (ii) to permit them to continue to operate for a limited period as in the past; and (iii) to permit them to continue to operate provided that environmental improvements are implemented. In almost all cases, modest environmental investments could generate a good return within 2-3 years. For these, the crucial point is that the choice should be restricted to (i) and (iii). If the government (or the enterprise) is unwilling to finance such improvements, then this amounts to a decision that the social benefits of keeping the plant open do not outweigh the costs, and the plant should be closed. If that is politically impossible, then the government should fix an absolute maximum term for the continued operation of the plant which is substantially less than the payback period for potential environmental investments.

This approach allows governments to make clear choices about the trade-off between the social costs of unemployment and of continuing environmental damage. It suggests, further, that all public enterprises should be subject to a gradual tightening of environmental conditions for continued operation under which managers are held accountable for making progressive improvements in environmental performance while they continue to receive government financial assistance.

ing in surrounding areas. By contrast, dust filters and other controls in lead smelters in the United States are able to ensure that those living no more than 1 km from the source do not have significantly higher levels of blood lead than those living at a much greater distance. Similar patterns can be found for emissions of benzene and other toxic organic chemicals from oil refineries, petrochemical and other chemical plants. While it may not be possible to achieve such high levels of emission reduction without large investments in redesigning plants or processes, significant improvements can typically be made at low cost.

Thus, new capital investment is only one part of the way that economic change will bring about environmental improvement. Indeed, it may not even be the most important part. The case studies reported below and many other examples consistently emphasize the importance of "good housekeeping" and of plant hygiene. This is a management issue. No amount of investment in better processes or environmental controls will solve the environmental problems of Central and East Europe countries unless it is backed up by effective supervision and maintenance.

On the other hand, major improvements can be made with minimal resources, simply by ensuring that plant and equipment is properly maintained, that environmental controls operate according to specification, and that leaks and spills are promptly dealt with. In large part this is a matter of commitment to and pride in achieving a better environmental record. Trivial but symbolic steps such as publicizing the achievement of plants or work groups which make significant environmental improvements can produce surprisingly large benefits. It follows that investments must be reinforced by expenditures on management and worker training and other programs to ensure that they bring the best possible returns in terms of improvements in environmental quality.

Operation, maintenance and repair (OMR)

It is frequently argued that safe drinking water, well-functioning public transportation systems, and collection and disposal of municipal waste are "basic" rights. At the same time, the priorities described here give the impression that there should be no investment in these areas. This impression derives from a confusion between *capital investments* and *expenditures to cover ongoing OMR costs.* Based on the general evidence throughout Central and Eastern Europe—and accepting that there may be significant exceptions in different countries—water supply systems in *urban* areas require much better maintenance, but not necessarily new capital investments (water supply in *rural* areas figures as a high priority in the list below). Similarly, public transport services should be maintained at an adequate level, but the evidence suggests that major new capital investments may not be warranted in the short-to-medium term. Municipal waste management is a growing problem, but expenditures in the short run should probably focus on better compaction equipment and landfill management to ensure that existing landfills are used in a more efficient and safe manner. Finally, the systematic treatment of hazardous, toxic or nuclear wastes is far beyond the reach of what CEE countries (or, for that matter even the wealthiest OECD countries) can afford, but this should not preclude carefully monitoring the disposal of such wastes, maintainign inventories, and undertaking the most urgent remedial measures where human health is at immediate risk.

Immediate priorities for public investment

Analysis of environmental health issues carried out in the course of preparing the Action Programme, and initial comparisons of the costs and environmental benefits of various investment programs, indicate that the following sets of measures should receive priority in the allocation of investment resources for environmental improvement over the next 5–7 years. This is a summary list; the various issues are described in more detail in **Annex 6** of this report and in the study on Sectoral and Local Environmental Expenditure Priorities prepared in support of the EAP.

(a) The installation of dust collection systems and filters to *non-ferrous metal smelters* which are located within 5 km upwind of significant centers of population. Priority should, in particular, be given to lead, zinc, copper and aluminum plants.

(b) The installation of equipment to reduce emissions of dust, smoke and soot, and carbon monoxide from *iron and steel plants,* especially those relying upon open hearth furnaces.

(c) Investments either to *replace coal* by gas or to permit the burning of smokeless solid fuels in district heating plants, commercial premises and households in those towns and cities where the average concentration of particulates during the winter months exceeds 150 _g/m^3.

(d) The provision of facilities to *pre-treat the wastewater discharged by small and medium-sized industrial plants* where contamination of groundwater and rivers by heavy metals is a significant problem, for example in towns and cities with a concentration of tanning, electro-plating and other metalworking plants.

(e) Assistance to facilitate the *proper installation of domestic septic tanks and the appropriate disposal of manure from intensive livestock operations in rural areas* where levels of nitrates in drinking water drawn from shallow wells typically exceed 10 mg of nitrate-N per liter.[3]

(f) Measures to ensure that the *disposal of domestic, toxic, nuclear and other hazardous wastes* is carefully monitored and that leachates from disposal sites do not contaminate ground or surface waters, especially sources used for the abstraction of drinking water supplies.

Box 5.2 and **Table 5.1** provide examples of major sources of pollution and identify some of the pollution control measures which are likely to offer the most cost-effective opportunities for reducing airborne emissions of

Box 5.2 The diversity of pollution problems and remedies

This box draws on selected case studies to illustrate the diversity and site specific nature of pollution problems and their possible remedies in the sectors studied.

The case study at *Trebovice power and district heating plant in the Czech Republic* revealed that three of the eight boilers at the plant (representing 65% of total capacity) are only fitted with mechanical collectors. The remaining boilers are fitted with ESPs, some of which have been operating for 15–20 years and are in poor condition. Parts such as collecting and discharge electrodes are likely to be worn out. Replacement of existing mechanical collectors and repair and modernization of existing ESPs would substantially reduce particulate emissions.

During the visit to the *Kosice iron and steel plant in Slovakia*, burnt lime fines were being deposited on the iron ore beds. As a result, the area around the yard was being covered with dust, despite moderate wind conditions. This material would be better returned to the sinter plant landing yard which is covered. All four units of the sinter plant have cyclones fitted, while two have ESPs fitted to the sinter breaker and screening areas but not the sinter exhaust stack. As a result, emissions from the stacks are dirty and will almost certainly contain relatively large amounts of fine oxide dust. The solution to these problems would involve changes in operating practices to improve sinter quality, and replacement of the ignition and filtration systems. The total cost of these measures is estimated at $12-18 million. The coke ovens at Kosice display signs of age and need repair. Most of the doors were leaking and there was a constant haze emanating from the top of the ovens. Detailed studies would be needed to determine the precise measures needed to reduce the emission levels but replacement of rehabilitation of the coke ovens may be necessary in the medium term. This would cost $100 million or more for Kosice.

At the *Copsa Mica lead smelter in Romania* much of the lead reaching the environment comes from the concentrate stage and handling. The site needs cleaning to remove deposits of concentrate that have accumulated around the site. Enclosing the storage building and equipping handling operations with water sprays and filter systems would substantially reduce emissions. These measures would cost about $0.5 million. Simply closing the side of the existing concentrate building would give a worthwhile improvement at a cost of less than $20,000. The installation of better process control would improve overall process and energy efficiency, and hence reduce pollution. Basic instrumentation and control systems would cost about $0.5 million. Other priority actions at Copsa Mica include: replacement or repair of the ESP fitted to the acid plant which was not operational during the visit and obviously had not been so for sometime; use of the hoods fitted to lead kettle operation which can be swung into position over the kettles, but which were not being used during the visit; and replacement of torn filter bags in existing bag houses.

At the *PO Kaustik plant at Volgograd in Russia*, a new membrane process plant has been delivered to the plant but the funds are not available for its installation. This plant would replace the existing mercury and diaphragm units, thereby eliminating mercury and asbestos pollution.

At the *Carom SA organic chemicals plant at Onesti in Romania* the SBR plant needs attention to the dryer section which is leaking styrene and butadiene. This could be improved by improved venting and control of vapors. The investment required would only be about $200,000. Generally, better monitoring at the site would identify leaks and enable appropriate repairs to be made.

The case study at the *Plock refinery and petrochemicals plant in Poland* identified a number of cost-effective measures to control VOCs. These include: improved sealing on asphalt oxidation to reduce emissions of polyaromatic hydrocarbons (PAHs) at around $1 million; modernization of existing equipment to better engineering design, venting of process units to appropriate devices such as flares, floating roof tanks etc for approximately $5–10 million; and improving maximum enclosure and venting of air from around the loading point to a control device at a cost of around $200,000.

pollutants harmful to health in the major industrial sectors.

Investments to deal with urgent problems specific to different countries

The foregoing priorities apply generally to all of the countries in the region, though the size of each problem differs from country to country according to their patterns of industrial production and of fuel consumption. There are, in addition, other areas for investment which should receive priority in individual countries because the environmental problems concerned are particularly damaging in specific circumstances. Among the investments that might be undertaken on this basis are:

(g) The installation of municipal wastewater treatment plants in towns and cities close to important tourist or wildlife areas, especially on the Adriatic, Baltic and Black Sea coasts, Lake Balaton, the Mazurian Lakes and the Carpathian and Rhodope Mountains.

(h) The completion of partially constructed wastewater treatment plants either in the upstream sections of seriously polluted rivers or where the bacteriological quality of water downstream of large towns and cities is particularly poor or where discharges are causing an unacceptable decline in the quality of water in rivers or lakes from which drinking water is abstracted.

(i) Implementation of sustainable rural development projects in defined areas of high biodiversity and great ecological importance that are under threat. Such projects should combine better management of protected areas with ecologically benign agricultural/forestry, tourism and other activities.

Low-cost measures to address longer term environmental problems

To complete this list of short term investment priorities, there are certain longer term environmental concerns whose future cost can be greatly reduced by relatively inexpensive measures taken now. The most important of these longer term priorities concerns the prospective dete-

Table 5.1 Priorities for Pollution Control

Sector	*Plant*	*Pollutant*	*Technology/Technique*
Power and district heating	Boilers	Particulates	ESPs or bag houses
Refineries and petrochemicals	Catalytic cracker	SO_2	de-SO_x catalyst
	Ethylene	VOCs	Improved vesting, good housekeeping
	BTX	VOCs	Floating roof tanks
Inorganic chemicals	Chlor-alkali	Mercury	Good housekeeping
	N fertilisers	Particulates	Prill scrubber
Organic chemicals	LDPE	VOCs	Improved venting
	EDC/VCM/PVC	VOCs	VCM stripping column, residue incineration
	Butadiene	VOCs	Improved venting
	Ethylbenzene	VOCs	
	Styrene	VOCs	Good housekeeping, residue incineration
	Polystyrene	VOCs	Improved venting, good housekeeping
	SBR	VOCs	Improved venting, good housekeeping
Iron and Steel	Raw materials handling and storage	Particulates	Water sprays, gas collection and cleaning system (bag house)
	Coke ovens	Particulates	Repair and rehabilitation
	Steel making	Particulates (stack gases)	Gas collection and cleaning system (bag houses or scrubbers)
Non-ferrous metals	Raw materials handling and storage	Particulates	Water sprays
	Smelters	Particulates	Gas collection and cleaning system
Pulp	Chemical pulp	VOCs	Gas collection and cleaning system
		H_2S	Gas collection and cleaning system
Small boilers and households	Boilers, coal stoves	Particulates, SO_2	Basic insulation measures, boiler control, fuel switching
		Particulates	Particulate control devices (boilers), replacement coal stoves

rioration of urban air quality caused by the growth in traffic that will take place when the economies of Central and Eastern Europe start to grow again. Pollution from mobile sources is not currently a primary concern in most towns and cities because of the high level of exposure to lead, articulates and other air pollutants from stationary sources. However, in cities such as Budapest, Moscow and even Warsaw, traffic is already or will soon be one of the main contributors to the moderate or sometimes high ambient levels of air pollution that they experience. The following expenditures would have a high return both by reducing current emissions and avoiding much worse problems in future:

(j) The establishment of vehicle testing stations combined with facilities for better vehicle maintenance in order to enforce reasonably strict emission standards for the commercial diesel vehicles—buses and trucks—which are the principal mobile source of particulate emission;

(k) A program to phase out leaded gasoline and to require that new vehicles (automobiles, buses and trucks) should, from some appropriate future date, meet the emission standards laid down by the EU. Most of the cost of these measures will be borne by refineries, automobile manufacturers and their customers, but resources for technical assistance and to deal with special transitional problems would speed up the implementation of these programs;

(l) Resources to fund applied research into a number of environmental problems for which solutions may be very costly (e.g., treatment of nitrate pollution) or where implementation of remedies has been difficult. Such research could focus on ecologically acceptable agriculture and forestry practices—especially their economic costs and benefits. Funds could also be given to support specialized research institutions engaged in important conservation efforts (e.g., botanical gardens); and to undertake well-defined studies on the ecological damage caused by large-scale development projects such as dams, canals, and large tourism developments; and

(m) Resources to strengthen the collection and dissemination of data on the state of the environment and natural resources. Particular attention should be paid to the forms of environmental damage and related issues which define the main priorities in this Action Programme.

Financing environmental investments

As a general principle, governments should contribute to the cost of environmental investments in enterprises only on condition that the enterprise also makes a contribution and if the cost of the investment is judged likely to be recovered over the remaining economic life of the plant. In effect, the latter condition means that investments should not be made in plants which are not viable at world prices. Such plants should be shut as soon as possible.

However, there is a case for extending short term government (or external) support to finance the installation of better pollution controls in a number of highly polluting industries. The question that must be asked for each plant is whether the stream of future income from the plant has a *positive present value* if the value of its existing capital equipment is treated as a sunk cost.[4] If it does, the government could make a contribution to the cost of environmental investment, in the form of either grants (based on the revenue from fees) or (preferably) loans paying realistic *real* rates of interest which must be repaid over a period of 5–7 years.

Plants with *negative net worth* might still be kept open temporarily if a sufficient premium were attached to maintaining employment or output in the industry or locality. There would then be a trade-off between the amount spent on environmental improvement and the length of time that the plant is permitted to operate. A simple system of categories could be established which takes account of the damage caused by the plant. Those in the worst category might be required to close down within two years, while those causing less damage might be allowed to continue to operate until 1996 or 1998. By suitable measures, plants could move themselves into a higher category and thus extend their permitted life, even if they had no permanent future. Again, government loans can be justified by the various factors which limit access to capital markets.

The prospective competitiveness of and demand for the output of many industrial plants is highly uncertain. However, few sectors will experience a medium term decline in demand of more than one-half, so it is possible to devise a simple ranking mechanism which could be used to identify those plants which would be eligible for immediate environmental investments. A scheme along the following lines could easily be introduced:

- Establish an Industrial Pollution Fund (IPF) to finance environmental investments in the most polluting industrial sectors: metallurgy, chemicals, pulp & paper, non-mineral metal products. The IPF would provide a combination of grants and loans amounting to not more than, say, $2.5 million to finance high priority environmental investments.[5] Most probably, it should operate as a specialized unit under the National Environmental Fund reporting jointly to the Ministries of Environment and of Industry;
- Enterprises should be eligible for assistance from the IPF if they are in the top 50 percent of all enterprises in their sector on both of two criteria—their profitability (revenues minus material and labor costs as a proportion of total revenues), and the average youth of their capital equipment;
- The IPF should retain consultants who would carry out a rapid environmental audit of any plant where an investment has been proposed by an enterprise satisfying the criteria above. The consultants should be asked to assess whether the proposed investment will have the effect of substantially reducing emissions of pollutants which threaten the health of those working in or living near to the plant and whether the proposal is a cost-effective method of reducing such emissions.[6] Such an assess-

Box 5.3 Checklist for cost-effective municipal wastewater investments

In order for municipal wastewater treatment investments to succeed, it is clear that there must be a sound financing plan, and that the right institutions must exist to ensure the sustainable operation of the investment.

It does not make sense, however, to invest a large amount of effort in this aspect if the benefits of the underlying investment are small compared to the costs. For example, if the installation of secondary wastewater treatment would cause little or no improvement in the ambient water quality, it may be better to defer the investment for the time being or limit it to primary treatment. This would be much less expensive and would not involve the large operating costs which require complex revenue raising arrangements to ensure the availability of recurrent financing.

The following is a checklist of factors that should be considered before proceeding with municipal wastewater investments:

[ ] Have measures been taken to reduce domestic and industrial water consumption?
[ ] Has industrial wastewater been pre-treated?
[ ] Is it possible to re-use and/or re-cycle water?
[ ] Can the proposed investment be analyzed in a river basin context? If so, have the merits of this investment been compared with the benefits from different kinds of investments in other parts of the river basin? Note that a least-cost solution to achieve improved ambient water quality may involve different (or no) technologies at different locations.
[ ] Has the most cost-effective technology been used to achieve a desired ambient water quality improvement?
[ ] Has there been an economic analysis to assess the benefits (in terms of ambient water quality) that could be achieved by phasing investments over ten or more years?

ment could be completed within a month and the proposal should be approved if the report is positive;

- Enterprises should be required to match finance provided by the IPF dollar for dollar. Most of the finance should be provided in the form of loans repayable over 5 years at modest *real* rates of interest—say 5 percent per year;
- External donors could contribute to the IPF itself and second staff for periods of at least 6 months to train those responsible for carrying out the rapid environmental audits and for evaluating the financial status of enterprises.

In addition to the type of expenditures classified under (a), (b), and (d), an Industrial Pollution Fund operating in this manner might also finance:

(n) The installation of equipment to reduce leakages of heavy metals, toxic gases and discharges of toxic wastes—to the air, in wastewater or in solid wastes—from petrochemical and other chemical plants, especially those located close to substantial towns and cities;
(o) The provision of industrial wastewater treatment facilities in plants—for example in the textile and pulp and paper industries—which discharge heavy loads of BOD and other pollutants into receiving waters which are relatively clean and lie upstream of large centers of population;
(p) Investments to mitigate discharges of saline water from mines in countries such as the Czech Republic, Poland and Ukraine, provided that the costs of such investments are recovered over the long run from the mines responsible for salt water emissions.

None of the cases under (o) and (p) involves serious and continuous damage to human health, though the economic losses caused by saline water are large. However, in cases (n) and (o) evidence that effluent discharges are contaminating drinking water sources with heavy metals or toxic chemicals is sufficient reason to move the issue into the category of problems deserving immediate attention. For chemical plants—category (n)—there are real but unquantified hazards to health. Plant employees are at greatest risk, but emissions of mercury, VCM (vinyl chloride monomer), and BTX (benzene, toluene and xylene) can pose a significant threat to the health of people living close to chemical plants. The exposure of workers should be covered under the normal provisions of occupational health and safety legislation, while action under environmental legislation is required to deal with off-site exposure.

In all cases the implementation of "good housekeeping" procedures will greatly reduce emissions, which tend to originate from leaks and spills that are allowed to persist. Such procedures will, usually, pay for themselves many times over by reducing losses of raw materials or products and by lowering the costs of standard operations.

The government may need to bear a larger share of the cost of environmental improvements for small industrial operations than for larger plants. This is because of the difficulty of monitoring their emissions, which makes the application of economic incentives or regulations much more difficult. Improvements in environmental performance may also be less closely linked to general efficiency gains, so that the enterprises concerned will be more reluctant to invest in eliminating or treating their emissions.

More generally, *government investments should be concentrated in the medium term on dealing with emissions from small industrial units, the service sector and households.* They must be used to discourage coal burning, to encourage domestic energy conservation and to find low cost methods of treating the large volumes of sewage that now pollute rivers and groundwater. These are measures which economic transformation will not bring about and which typically require intervention by the public sector.

Most small scale users of coal are very happy to switch to gas, even if it costs more, because of the convenience and labor-saving that it allows. The principal constraint is the availability of capacity in local gas distribution networks to meet a widespread demand for household heat-

Box 5.4 Biodiversity conservation—short-term investment examples

The following sites have been selected on the basis of their regional importance for biological diversity and vulnerability to immediate threats which would result in irreversible damage. Further, the approach proposed demonstrates the twin advantages of: (i) conservation of the biological and landscape (including cultural) diversity and, (ii) income-earning activities for local people. A mix of integrated activities are required including direct short-term and medium-term investment, technical assistance for policy and institutional support, and training. Negotiations between international donors and a range of national and local government departments should be able to fashion appropriate financing packages. The projects offer an opportunity to put into practice and test the calls from UNCED for sustainable development and to apply the principle of cost effective prevention of degradation in Eastern and Central Europe rather than expensive "cure" as is the case in western Europe.

Albania: *Karavastas Lagoon/Dijvaka Pine Zone.* This area is located on the coast 100 km south of Tirana. It has world importance biologically by virtue of a nesting colony of Dalmatian Pelican and is said to have several endemic plant species, including orchids, but a detailed survey is required to confirm this. The occasional occurrence of the Mediterranean Monk Seal and White Tailed Eagle, both threatened on a regional scale, have been reported. The site is threatened by inappropriate tourism, agriculture and hunting and is extremely vulnerable in that there is no effective legal protection or management plan, and the economic plight of the local population encourages short-term exploitation above the carrying capacity of the natural systems.

Bulgaria: *Strandja Mountain and Adjacent Coastline.* The overriding natural value of the area lies in its forests which cover more than 81,000 ha. Eastern Europe contains areas of forests that are now unique in Europe. There are 15 endemic species and Strandja is the only place in Europe where the wild Medlar tree is found. All five of the reptile species at the site are in the *International Red Data Book.* Regeneration of natural forest in the place of plantations depends in part on grazing, yet there is serious decline in the size of the human population (1.09% a year between 1975 and 1985). The area also has forty historically interesting houses and churches which have been identified for restoration. The region is suffering from encroachment of ecologically damaging tourism along the coast (sand dunes have already been destroyed and marshes polluted), inappropriate forestry methods, new land-ownership arrangements in the absence of land use guidelines and management plans, and water pollution from pig farms. The depressed economic situation renders the area extremely vulnerable to unsustainable exploitation of the natural resources.

Croatia: *Lonjsko Polje Nature Park, Middle Sava Valley.* The park covers one of the largest semi-inundated areas left in Europe (50,560 ha). Its regional importance is particularly clear in threatened breeding of migratory bird populations (e.g. spoonbill, white stork) but also in its otter population and waterplant communities. There are four important, interdependent habitat types: alluvial forests; open regularly flooded grassland; traditional farmed landscapes and fishponds. The threats include drainage and transformation of wetlands into arable land; over-intensive use of forests; air and water pollution from nearby industrial plants and intensification of agriculture; alterations in the hydrology through construction of dikes; and proposed dam construction and transport routes. Maintenance of the landscape and biological diversity depends on solving the economic reasons for migration from the region as well as adjustments in agricultural, industrial and transport policy.

Romania: *Retezat National Park and Buffer Zone.* Of the species identified on the site, 5.2% are endemics and one plant (Draba dorner) covers just 400 m^2. The scientific reserve within the site is considered to be the European genetic center for certain grasses and spurges. Twelve fish, 32 bird and 22 mammal species are found in the park. Threats include a 2 million cm^3 lake and an associated hydro-electric plant which will eventually generate 348 MW, and which are already nearing completion, tourism development without an overall management plan, and overgrazing. The presence of former state farms in the vicinity of the park (now partially abandoned) offers the possibility of providing a model of ecological reconstruction that could be replicated elsewhere.

The Russian Federation: *Losiny Ostror (Elk Island) National Park, Moscow.* The park is unique in Europe and possibly the world, as the only natural complex of such size (13,000 ha) partially within the boundaries of a large capital city with, above all, a population of beavers. Forty-five species of mammal are present including elk; rare birds visit on migration. The park is the only virgin natural area surviving around Moscow and contains one of a handful of virgin forests outside Zapovedniki in central Russia. Threats include increases in traffic using the roads across and around the park; air, soil and water pollution; pressure from unregulated visitor numbers and illegal encroachment with built structures. A successful project to manage this natural "island" will not only save severely threatened habitats and species but will also serve as a valuable demonstration for other similar projects on the borders of urban areas.

ing. In Bulgaria, gas supplies were restricted to large industrial consumers, so a new distribution system will be required. In Poland, local pipelines were designed to meet household demand for cooking but not for heating. Thus, a substantial investment program spread over a decade or more will be needed to develop the infrastructure required to enable households to switch away from coal to gas. Priority should clearly be given to the distribution of gas in areas where exposure to particulates and/or sulfur dioxide is especially high and the burning of coal makes a large contribution to this air pollution.

As far as possible, such public investments should be designed to act as catalysts which stimulate private responses to the incentives provided by policy reforms and mobilize private investment to bring about economic changes that have environmental benefits. There is also a more traditional role for public investment to finance high priority projects in those sectors which require collective action to provide basic environmental services—for example, infrastructure services such as waste collection and disposal, management of water resources as well as nature conservation, information services and research.

Notes

1. Transboundary and global problems and action required are mostly dealt with in chapter VI. A much more complete discussion of some of the issues contained in this chapter and in **Annex 6** is provided in the technical report on *Sectoral and Local Environmental Expenditure Priorities* prepared as a basis for the EAP.

2. *Economic* justification refers to the benefits accruing to the country and include social benefits in the broadest sense; *financial* justification refers to the enterprise.

3. The proposed threshold is based on the standard WHO guideline, which is identical to US guidelines for the quality of public drinking water. The threshold allows a considerable margin of safety so that a less strict threshold of 20 mg/l of nitrate-N would prevent almost all cases of methemoglobinemia. The EU drinking water standard specifies that nitrates should not exceed 50 mg/l of NO_3 which is equivalent to 11 mg/l of nitrate-N.

4. *I.e.*, the residual capital of the enterprise is considered to have no economic value.

5. If budgetary constraints are severe, then this upper limit could be reduced to ensure that no grant or loan exceeds 5–10 percent of the fund's total resources.

6. In ecologically sensitive areas the environmental audit could be extended to cover an assessment of whether the investment would contribute to the prevention of irreversible damage to local ecosystems.

Chapter Six

Transboundary Issues: Regional and Global Concerns

Chapter Contents

A strategy to address regional or global problems of air and water pollution must build, as far as possible, on the overlap between the local and the transboundary impacts of measures to reduce emissions. Market reforms and policies or investments to meet domestic environmental goals will lead to large reductions in emissions of regional and global air pollutants. If further reductions are required in the CEE countries to meet regional or global concerns, then donors may wish to consider bilateral or multilateral funding to cover the net incremental cost of meeting stricter emission targets. Such arrangements would be particularly appropriate where the marginal costs of reducing emissions vary widely across countries.

Maximizing the joint domestic and transboundary benefits of improving water quality implies that resources should primarily be directed to the reduction of emissions from coastal or estuarial sources. This will contribute to the preservation of coastal ecosystems as well as reducing the nutrient flows which are the main source of transboundary damage.

All environmental problems have a local origin, but may affect a much broader area. The solutions to these problems likewise will have implications locally, across boundaries and globally. For example, emissions from burning fossil fuel originate at one point and must be controlled there. The impact can be local, if soils and air immediately surrounding the source of the emissions are contaminated; it may be transboundary, if the emissions descend some way off as acid precipitation; and it may be global, as emissions contribute to the cumulative build up of greenhouse gases.

Action to control the broader effects of local problems has been taken principally through regional and global agreements. In this Action Programme, the focus is on measures which minimize the net costs of complying with international agreements by addressing, as far as possible, both the domestic and transboundary damage caused by emissions.

However, it is important for individual CEE countries to be clear about whether the reason for pursuing a particular policy is local or regional. For example, the main local effects on air pollution of burning fossil fuel arise in terms of suspended particulates, which are an important cause of damage to health; the effects on health from sulfur dioxide emissions are less severe. But sulfur dioxide emissions, through their effects on acid precipitation, are of more concern to neighboring countries than suspended particulates. CEE countries therefore are sometimes urged by neighboring countries to give priority to reducing their contribution to acid rain.

The costs of reducing suspended particulates are much lower than the costs of addressing sulfur dioxide output (**Box 2.5**). A recent study of air pollution in the southeastern Polish town of Tarnobrzeg found that the benefits of reducing sulfur dioxide were invariably lower than the costs, while the benefits of reducing suspended particulates by up to 70% invariably exceeded the costs. The local balance of costs and benefits, in other words, may differ substantially from the regional or global balance.

Regional Concerns: Air Pollution

Transboundary air pollution in Central and Eastern Europe is dominated by the problem of acid rain, which is linked to emissions of sulfur dioxide and nitrogen oxides from power stations, large industrial plants, small scale

Box 6.1 The environmental damage caused by acid emissions

Sulfur dioxide (SO_2) is an irritant which, in high concentrations, can cause acute respiratory conditions. In conjunction with high levels of exposure to particulates it is implicated in the excess mortality observed during severe smogs and it worsens the morbidity associated with chronic respiratory problems. Exposure to high levels of nitrogen dioxide can also worsen the health of those with pre-existing respiratory problems. But it is through its contribution to the generation of photochemical smog and ozone (another respiratory irritant that aggravates the condition of people with asthma and heart disease) that NO_x emissions have their main effect on health.

High levels of SO_2 and NO_x emissions can damage buildings and other structures because of relatively high concentrations of acid and of sulfur particles in rainfall. Much concern has been expressed about damage to cultural artifacts and especially historic buildings in cities such as Krak_w and Prague. It is, however, difficult to disentangle this damage from that caused by poor maintenance and mistaken attempts at restoration in the past. While the scale of the damage to materials caused by acid emissions is uncertain, they undoubtedly give rise to amenity costs because they reduce visibility. The presence of sulfate and nitrate particles plus acid aerosols, as a result of either direct emissions or their secondary formation in the atmosphere, leads to light scattering. Further, gaseous nitrogen dioxide absorbs light at the high end of the spectrum, which gives the atmosphere a reddish-brown tinge. The result is a haze which may extend over a large region such as Upper Silesia and Northern Bohemia or Eastern Ukraine. Alternatively, topographical features may concentrate the haze over a city.

Depositions of sulfur and nitrogen or "acid rain" are primarily associated with the long distance transport of acid aerosols formed in the atmosphere from a mixture of dilute hydrochloric, nitric and sulfuric acids plus ammonium sulfate and nitrate. Rainfall gives rise to wet deposition which rapidly infiltrates soils, groundwater, rivers and lakes. Both dry and wet depositions may cause direct damage to trees and other vegetation by affecting their plant chemistry and pathology. Acidification of soils leads to a leaching of plant nutrients combined with the mobilization of aluminum that would otherwise be bound up in rocks and mineral particles. An excessive level of aluminum damages roots, reduces the capacity of plants to take up necessary trace elements such as calcium and magnesium, and interferes with water transport within trees which increases sensitivity to drought. Acidification of rivers and lakes can result in drastic changes in their ecosystems including the complete loss of fish stocks.

The dose-response relationships between acidic emissions and damage to forests, crops and lakes are complex and still poorly understood. Rainwater has not become significantly more acid (lower pH) in Central Europe over the last 50 years, but the area covered by highly acid rainfall has increased greatly. Evidence from Germany and other West European countries suggests that forest loss may be linked to the long term effects of acid depositions but that a variety of other (often site-specific) stress factors are also involved.

The nature of the damage to ecosystems caused by acid rain means that it is necessary to distinguish between "stock" and "flow" aspects of the problem. Long term acidification of soils is a "stock" problem which cannot be quickly reversed by reducing the level of current depositions, though applications of lime and nutrients and changes in silvicultural practices may mitigate its consequences. At the same time, it is possible to define "critical loads" which represent the maximum "flow" of acid depositions that can be absorbed by specific soil types without provoking a tendency to acidification. These critical loads define a measure of long run sustainability which can be used in setting the ultimate goals of environmental policy. However, in setting priorities for short term actions, countries must also consider how far immediate measures to reduce acid emissions will affect the amount of damage that will occur over the next few years.

The implication is that short term priorities should focus on the local, health-related, damage caused by acid emissions while damage to ecosystems should be the basis for a longer term reduction in emissions from those sources and regions which have contributed most to acidification in the past. Any measures to alleviate the local damage caused by sulfur dioxide and other emissions should be consistent with *achieving a declining trend in emissions*, which would *not*, for example, be the case with a tall stack policy.

and household burning of coal and other fuels, and motor vehicles. **Box 6.1** describes some of the scientific aspects of the environmental damage caused by acid emissions. The CEE countries are important contributors to transboundary flows of acid pollutants—**Maps 5 and 6** illustrate the distribution of acid emissions in the area of the Central European Initiative (CEI). They are also large recipients of acid depositions from other countries, so that, for example, almost 50 percent of Poland's acid depositions originate from outside Poland. Thus, environmental policies to address the problems caused by acid rain must take account of the flows between countries and of the joint efforts by European countries to reduce emissions. This was one of the motivations for the development of the Geneva Convention on Long-Range Transboundary Air Pollution and its related protocols.

While public attention has tended to focus on the transboundary dimension of sulfur and nitrogen oxide emissions, the damage caused within individual countries by these emissions (either on their own or in combination with particulates) is at least as important. There will often be important localbenefits from reducing emissions of sulfur, particularly in regions where ambient concentrations of sulfur dioxide are high—for example, Northern Bohemia, Upper Silesia and the areas near to large lignite-fired power stations in Poland, Bulgaria, Hungary and other countries. Appropriate measures to control sulfur emissions in such locations may be in the national interest without any regard to transboundary concerns. The transboundary benefits of such measures reinforce the case for action.

Studies of the transport of acid pollutants show that an average of only 10–25 percent of sulfur and NO_x emissions stay within the 150 km grid square from which they originate. Of course, the average concentration of these gases is highest in the area where they arise. Particular combinations of topography and weather may temporarily trap emissions in smog close to the ground and cause dramatic increases in respiratory morbidity or mortality, especially among children and the elderly. Such

smog emergencies can cover wide areas over several countries and are greatly exacerbated by high concentrations of particulates. They can be alleviated by requiring power plants and other large sources either to close down temporarily or to switch fuels. This illustrates the importance of implementing measures which address both peak and average levels of exposure to acid pollutants.

The crucial questions about policies to reduce pollution that crosses boundaries are (a) how far they should go beyond policies that can be justified on the basis of their local benefits alone? (b) how should these additional measures be financed? Answers to both questions depend upon the nature of the cost curve for reducing total emissions and the marginal benefits of improving local ambient conditions. The larger are the marginal local benefits relative to the costs, the less will be the investment and other costs of meeting specific targets for reducing transboundary flows.

Policies to reduce transboundary emissions

Substantial reductions in emissions of acid pollutants can be achieved at relatively low cost by a combination of fuel switching (both to low sulfur fuels and to gas) and changing the utilization of installed equipment. Beyond a certain point, which will vary from country to country, further reductions in emissions will typically involve a large increase in the marginal costs of control.

Emissions of sulfur and NO_x from large stationary sources are prime candidates for the application of economic instruments—either pollution charges or tradeable permits.[1] An appropriate system of pollution charges can easily be developed within the framework of current legislation in most Central and East European countries. Mobile and small scale emissions of sulfur can be covered by imposing differential charges on fuels. In due course, it will be necessary to require that new vehicles should be fitted with catalytic converters in order to avoid a rapid increase in NO_x emissions as well as traffic-related urban pollution. Over the next decade, however, it is likely to be more cost effective to concentrate on reducing sulfur and NO_x emissions from large sources.

Even if a country does not intend to rely upon market-based instruments to reduce emissions of sulfur, the idea of pollution charges provides the basis for ranking alternative measures to meet a given target. The cost curve of different measures for a particular country is constructed by considering what measures would be implemented if a tax of, say, US$100 or US$200 per ton of sulfur emitted were imposed. The information provided by this analysis tells us where capital-intensive controls such as desulfurization of oil or of flue gases appear in the cost curve. Such estimates are essential to any attempt to assess the extent to which CEE countries may require assistance in order to conform with the targets now being negotiated for a second sulfur protocol under the Convention on Long-range Transboundary Air Pollution.

It is essential to examine the costs of reducing emissions of sulfur from groups of sources in aggregate rather than applying a piecemeal plant-by-plant approach. The alternatives for reducing sulfur emissions from a single source may be quite limited. The main ones are: the use of low sulfur coal or oil; switching from coal to oil or gas; the installation of in-furnace controls or of FGD; or the partial or complete closure of the source. If emissions come from several sources, the key question is how the total reduction is to be shared out. Again, the answer can be found by mimicking the ways in which sources would respond to the imposition of different levels of pollution charges on sulfur emissions. For example, this would take account of possible adjustments in the number of operating hours for power-generating plants. It would clearly not be efficient to commit large sums to installing expensive controls at a high-emission plant if an equivalent reduction in emissions could be achieved by operating the plant for fewer hours per year and replacing its output with production from a low-emission plant, albeit one with higher operating costs.

The great merit of relying upon market-based instruments is that they allow enterprises to find low cost solutions which may not be apparent to regulators. It follows that models are likely to overestimate the marginal cost of reducing emissions and the level of the emission charge necessary to meet a particular target.

A study of the costs of controlling sulfur emissions for the United Kingdom illustrates the implications of this approach.[2] The savings permitted by adopting a single target for total UK emissions or targets for separate regions within the country instead of imposing uniform technological standards or emission targets on all individual emitters are potentially large. For example, if a single target for Great Britain were established and plants were allowed to trade sulfur emission permits, the cost of achieving the level of emissions implied by applying the EU's Large Combustion Plant (LCP) directive[3] to each individual plant would be 15–20% lower than the cost of imposing the same limit on each plant separately.

In the longer term, increasing attention could also be given to *Integrated Resource Planning*, especially in the power sector: Power stations may find it less expensive to

Box 6.2 Low cost options to reduce sulfur dioxide pollution

- Use low sulfur coal or fuel oil
- Switch from burning coal to fuel oil, or from both to gas
- Temporarily close down large industrial plants—e.g. iron & steel mills, large petrochemical plants, pulp mills—when there are temperature inversions or sulfur dioxide levels are very high
- Reduce the number of operating hours per year of power plants burning sulfurous fuels by placing them lower in the ranking that governs how plants are brought on-stream as the total demand for electricity increases.

Box 6.3 Black Triangle Environmental Programme

The Black Triangle Environmental Programme was established in August 1991 by the environment ministers of Poland, Czechoslovakia, and Germany. The Commission of the EU later became the fourth official partner (the Czech Republic took over the functions of the CSFR). To date, a framework plan has been endorsed, a Programme Coordination Unit established in Usti nad Labem (Czech Republic), and a joint air monitoring system is being established.

obtain "additional" power capacity by financing energy *savings* investments among their clients, rather than to invest in new power production facilities. To achieve this, power production and energy savings will eventually be given equal weight, thus offering additional opportunities for reducing emissions of pollutants associated with the energy sector.

Combining local and transboundary concerns

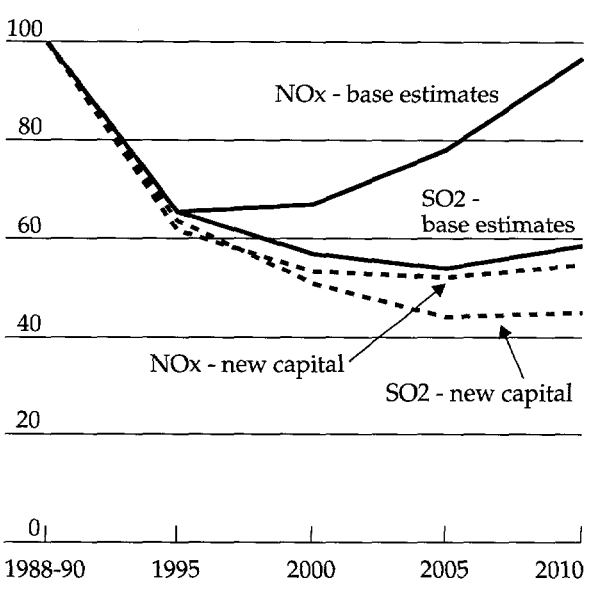
For the most part, there is no conflict between measures that reduce local, national and transboundary damage. As the scenario analysis demonstrates, the pursuit of appropriate economic and industrial policies will lead to a substantial fall in emissions of sulfur dioxide and of NO_x for most countries in the region up to the end of the century. This point is reinforced by **Figures 6.1-6.3** which show total emissions of these pollutants for Central and South-Eastern Europe, Russia and other European countries of the former Soviet Union. Under a combination of economic reform and minimal environmental regulations, emissions of sulfur dioxide could fall by 40–60 percent over the next decade. Stricter but affordable environmental policies (equivalent to requiring that all new capital meets current EU emission standards) could ensure that emissions of sulfur dioxide are at least halved by 2005. For NO_x the decline in emissions in the base scenario is rather less, especially for Central and South-Eastern Europe, because of the growth of emissions from vehicles. Even so, the imposition of EU standards on new capital and vehicles alone should result in a reduction of almost 50 percent.

These results show that it is possible to ensure that total emissions of acid pollutants from the countries of Central and Eastern Europe follow a declining trend towards meeting long term goals based on criteria of sustainability such as critical loads, without imposing excessive costs. **Map 9a** shows that under the scenario in which EU standards are achieved by 2010 for all new plants (Scenario 1), critical loads for acidity would be exceeded mainly in the most sensitive areas of Central Europe. If the much more expensive policy of bringing *all* CEE large sources up to EU standards were adopted (Scenario 2), there would be no significant exceedances in Central Europe (see **Map 9b**). A more selective approach is therefore required which would rely more heavily on economic incentives rather than uniform emission standards, and which would focus on key hot spots.

Reduction targets are currently being negotiated within the framework of the Convention on Long-range Transboundary Air Pollution; in contrast to the first sulfur protocol discussions, those for a second sulfur protocol are based on internationally differentiated reduction targets, to take into account differences in reduction costs and in damages at different locations. The nature and phasing of these targets must, of course, also reflect the short and medium term priorities of each country, for which a clear understanding of the national as well as the transboundary benefits of emission reductions is essential.

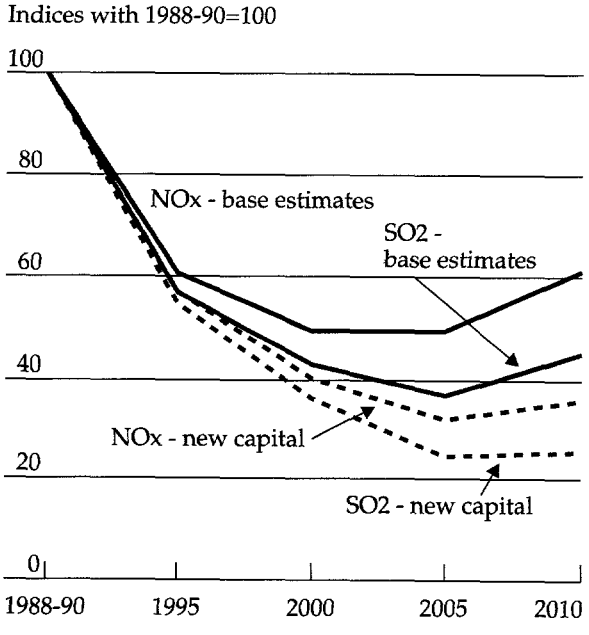
A future international agreement aimed at reducing transboundary environmental damage may, for a particular country, entail abatement measures whose cost cannot be justified on purely local and/or national grounds, including the benefits of thereductions made by other parties to the agreement as well as the wider economic and political benefits of international cooperation. The Stockholm Declaration, in the spirit of the Polluter Pays Principle, states that countries in this situation should bear the costs of reducing emissions to avoid causing significant damage to the environment in other countries. Nonetheless, for hard-pressed countries in Central and Eastern Europe the costs of undertaking an accelerated program of emission reductions to meet such international obligations may involve an unacceptable diversion of resources from domestic environmental or other objectives. Some coun-

Figure 6.1 Total emissions of sulfur dioxide and nitrogen oxides from Central and South-Eastern Europe



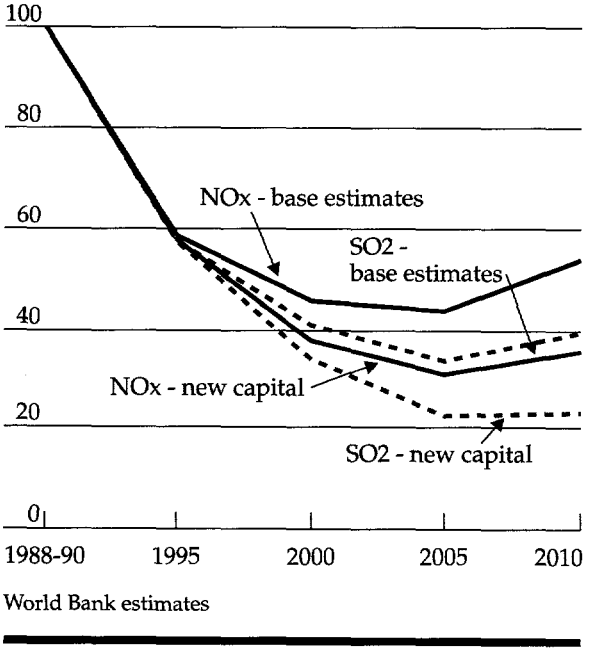
World Bank estimates

Figure 6.2 Total emissions of sulfur dioxide and nitrogen oxides from Russia



World Bank estimates

Figure 6.3 Total emissions of sulfur dioxide and nitrogen oxides from other countries of the former Soviet Union



World Bank estimates

tries might, therefore, decide not to participate in the agreement or might find themselves unable to afford to make the emission reductions which they had committed themselves to.

Provided that the total benefits of emission reductions to all the countries involved exceed the costs, there should be ample scope for those who benefit most to assist individual CEE countries to meet more ambitious targets. Such agreements would leave all parties better off. **Box 6.4** illustrates a number of ways that international agreements could be made more flexible. Minimizing the net cost of meeting international agreements is in the interest of both individual countries and of Europe as a whole. By lowering the net cost of reducing transboundary flows, countries could afford to act earlier or to adopt more stringent reduction targets. Countries which provide assistance will not agree to open-ended commitments, so that any such arrangements could only operate over a strictly limited period. Thereafter, recipients would be expected to meet the final targets without help, so that the agreements would not affect the long-term commitment to the Polluter-Pays Principle.

Regional Concerns: Water Pollution

When a *river* or *lake* is shared by several countries, pollution and conservation become a *regional* issue. A number of international conventions regulate access to and use of these shared resources. The most relevant is the 1992 ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes. Similarly, there are a number of international conventions to manage discharges where *coastal areas* and *inland seas* are shared.[4]

River pollution has different local and regional impacts, depending on the type of the receiving water and the pollutants involved. In many cases, the local effects of pollution from organic material (oxygen depletion) are compensated by the "self-purification" capacity of rivers. This is the case if the flow is reasonably rapid and dilution is large (as for the main river Danube). Thus, some rivers carry large loads of suspended solids, BOD and to some extent phosphorus, without causing local problems.[5] However, there are large problems in the Baltic and Black Seas—into which these rivers flow—caused primarily by phosphorus and nitrogen loads. This peculiar feature of water pollution calls for strong international coordination.

Transboundary water pollution raises many of the issues of the appropriate balance between local and international concerns that have been discussed for the case of transboundary air pollution. Problems arise from the relationship between neighboring countries along the banks of international rivers. For example, phosphorus and nitrogen levels in the Danube are already very high by the time the river reaches Slovakia; from there on, it is very difficult to achieve any significant improvements in the water quality of the Danube in the downstream countries. One simple solution would be to set a target that the quality of water that leaves the country is no worse than the quality of water in rivers that enter the country. The strict application of this goal may not be feasible or, indeed, sen-

Box 6.4 Mechanisms to share the burden of reducing transboundary pollution

The transboundary benefits of reducing air pollution can be "internalized" in various ways:

Direct Deals. Countries that expect to benefit from a reduction in emissions may offer to finance part of the cost of installing controls or adopting other measures to reduce emissions. So long as there are only a small number of origin and destination countries involved, negotiations of this kind can lead to an efficient outcome. The main difficulty is that transboundary flows from a single country (or, even, from a single large emitter) will typically cause damage in several countries. Some beneficiaries may, then, be tempted to "free-ride" by offering less than the full value of their benefits from a reduction in emissions in the hope that other beneficiaries will contribute a larger share of the cost of reducing emissions. Strategic behavior of this kind will achieve less than the efficient level of emission reductions.

Compensatory Premia. The idea of pollution charges can be extended to introduce a system of premia for countries which reduce their emissions below agreed base levels. Beneficiaries could contribute to a fund which would be used to pay each source country a premium (per tonne of sulfur or NO_x) reflecting the transboundary benefits of incremental reductions in its emissions which should be built into the comparisons of the costs and benefits of alternative domestic measures and would shift the balance towards more stringent reductions. This approach avoids many of the difficulties of multilateral negotiation when there are several beneficiary and source countries, but strategic behavior by beneficiaries may still result in a lower level of compensation and reductions than would be efficient.

Tradeable Permits. Each country would be allocated permits corresponding to the basic level of emission targets. Countries wishing to see larger reductions in permits could buy but not use permits from the source countries whose emissions most affect them. This mechanism is more transparent than direct negotiations and should lead to a more efficient result, but, as for all permit trading schemes, the non-uniform impact of emission reductions in different locations causes problems. Where one country's emissions affect several countries, it will be necessary to put together a coalition of beneficiaries to buy permits, which will lead to the difficulties outlined in the Direct Deals described above. The great advantage of tradeable permits is that they can provide the basis for reducing total emissions from a group of countries at minimum cost without requiring the monetary payments associated with compensatory premia. Thus, a permit scheme would be more appropriate for global pollutants like carbon dioxide whose origin is unimportant than for regional pollutants like sulfur dioxide whose origin is critical to the marginal damage caused by emissions.

Certain problems are common to all of these schemes and, indeed, to any international agreement to reduce emissions of acid pollutants. Monitoring total emissions is difficult and estimates of total emissions are quite uncertain. It is hard to devise enforceable penalties for countries which fail to honor undertakings to reduce emissions, though most will wish to do so, if only to retain their credibility in future international negotiations. Payments under any mechanism may be staged or linked to the implementation of specific investments in emission controls, but these cannot avoid the problem that the extent of emission reductions may depend upon the maintenance and operation of the control equipment.

International negotiations over emission targets are what economists call a "repeated game" since they occur at more or less regular intervals. Some people have, therefore, suggested that any mechanism involving compensation for reducing emissions will encourage some source countries to increase their emissions. In fact, this will not happen so long as it is possible to monitor levels of emissions, which is an essential pre-condition for any such agreement. Assuming that there are domestic benefits from reducing emissions, any compensation offered will be less than the marginal cost of controls, so that strategic behavior of this kind would leave the country worse off. In any case, countries are rightly concerned about their reputation which is a critical aspect of any repeated game, since the penalties for being thought of as an unreliable partner can be high. The short term gains from such strategic behavior will, therefore, be greatly outweighed by the prospective costs.

sible where large cities or industrial centers are located just upstream of a border. Nonetheless, it embodies the fundamental principle of international law that upstream countries should not cause appreciable harm to countries downstream.

Most of the international concern about transboundary water pollution has focused on the long term threat to enclosed seas such as the Baltic, the Black Sea and the Mediterranean. These problems are primarily associated with flows of nutrients and the danger of eutrophication. The impact of untreated sewage discharges from coastal towns and cities in the Baltic and the Black Sea also raises issues of coastal zone management, although such discharges are more easily tackled because there are substantial local benefits from reducing them and the costs involved need not be large.

Chapter V gave high priority to investments to prevent irreversible damage to sensitive coastal ecosystems and to protect economically valuable coastal industries—especially tourism and fishing. Such measures, which are important for purely local reasons, will also make a significant contribution to reducing BOD and nutrient loads in the Baltic and Black Seas. Thus, transboundary considerations reinforce an already strong case for giving priority to such investments over other forms of wastewater treatment.

Taking account of transboundary as well as local concerns may justify the installation of treatment technologies in coastal centers which remove more nitrogen and, perhaps, phosphorus than those which would be appropriate on the basis of local considerations alone. The additional investment required would justify international assistance (**Box 6.5**).

There is considerable uncertainty about the extent of the transmission to the sea of BOD and nutrients from upstream cities, industries and agricultural run-off. While big rivers such as the Danube, the Dnieper, the Don, the

Box 6.5 Environmental Programs dealing with international waters

The Baltic Sea Joint Comprehensive Environmental Action Programme

At a Diplomatic Conference in April, 1992 in Helsinki a new Convention on the Protection of the Marine Environment of the Baltic Sea Area was signed to supersede, upon entry into force, the 1974 Helsinki Convention. On the same occasion, the Environment Ministers or High Representatives of eleven countries in the Baltic Sea drainage area, as well as of the European Communities, adopted a strategy for addressing the environmental problems of the Baltic Sea, as outlined in the Baltic Sea Joint Comprehensive Environmental Action Programme. They also established, within the framework of the Helsinki Commission, a Programme Implementation Task Force (PITF) to co-ordinate, facilitate and monitor implementation of the Programme, as well as to initiate its periodic updating. All the 14 countries in the drainage area of the Baltic Sea, as well as the European Commission, EBRD, EIB, NIB, the World Bank, and the International Baltic Sea Fishery Commission are members of the HELCOM Task Force.

In preparing the Programme, detailed studies of wetlands, agricultural run-off and atmospheric deposition of pollutants were carried out as well as pre-feasibility studies in eight former centrally-planned economies (including the Eastern states of Germany).

Implementation of the Programme was estimated to cost at least 18 billion ecu over 20 years (at 1992 prices). Measures to reduce emissions from 98 hot spots in Central and Eastern Europe—covering both point and non-point sources—would cost at least 8.5 billion ecu. Among these hot spots, 47 have been identified as priorities which would require an estimated budget of 6.5 billion ecu to cover the cost of investments and other measures to deal with their emissions.

Efforts are being made to ensure that feasibility studies are carried out as rapidly as possible for the measures required at the priority hot spots. On 24-25 March 1993 a conference was held in Gdansk to mobilize resources to fund the initial stage of the Programme with the participation of bilateral donors and multilateral financial institutions. The Gdansk Conference endorsed the guidelines for implementation of the programme: "The Baltic Sea Joint Comprehensive Environmental Action Programme; Opportunities and Constraints in Programme Implememntation."

Black Sea Environmental Management Programme

The Black Sea Environmental Management Programme has been initiated in conjunction with the Global Environment Facility and other donors in cooperation with the littoral states—Bulgaria, Georgia, Romania, the Russian Federation, Turkey, and Ukraine. The program's main purpose is to identify the principal sources of pollution of the Black and Azov seas, which has resulted in extreme eutrophication and a drastic decline in fish populations and biodiversity.

Environmental Programme for the Danube River

The main objective of the Environmental Programme for the Danube River is development of a Strategic Action Plan (SAP) for environmental improvement in the Danube countries. The actions proposed (including investments, technical assistance and institutional development) will be closely linked to the implementation of the Danube Convention which is to be signed in 1994. The Plan is not designed as a donor program, but as a tool for the countries themselves to set realistic priorities for the implementation of the Convention—a process to which the donor community has indicated an interest to contribute.

Dvina, the Oder and the Vistula carry large loads of these pollutants into the Black Sea and the Baltic, it is difficult to establish what proportion of the total load originates from sources more than 100–200 km upstream. During the initial stages of programs to address these problems it will generally be advisable to concentrate the limited resources for dealing with transboundary pollution on downstream sources. As better information becomes available on both the principal sources and the transmission of pollutants, it will be possible to develop a more comprehensive framework for emission reductions in international river basins which will maximize the domestic and transboundary benefits of control expenditures. This implies that over the next 3-5 years countries should follow a two-pronged strategy of concentrating domestic resources on protecting coastal waters and improving upstream water quality—see Chapter V—while external resources are directed towards downstream sources which have the most direct impact on the sea concerned (**Box 6.6**).

In conjunction with these measures it is important to build up the information and a framework of cooperation needed to take stronger action in future if justified. This would cover:

- an assessment of water pollution affecting shared water resources as a basis for determining the most cost-effective control measures;
- the development of systems to collect and exchange information about trends in water quality and emissions;[6]
- the coordination across countries of water policies and regulations affecting shared water basins—including, if appropriate, a joint water basin management agency responsible for implementing cooperative programs.

Wetland management

The management of water resources and quality has a significant impact on inland and coastal wetlands, which are internationally important because of their role as habitats for migratory birds. These issues are addressed by the 1971 Ramsar Convention on Wetlands of International Importance, to which most Central and East European countries are now Parties. The Danube and Volga deltas, Lake Balaton and Lonsjko Pole are among the most important sites in the region. The immediate threats are from the expansion of agriculture and of settlement which leads to the drainage of wetlands. Heavy

Box 6.6 Possible wastewater investments which meet both domestic and transboundary objectives

The Baltic Sea program sets out an extensive list of wastewater treatment projects to be implemented gradually over the next two decades. Applying the criteria developed for the Action Programme to these projects suggests that a number of them should have priority because they will generate substantial local or national environmental benefits, as well as significantly reducing pollution in the Baltic. These projects include:

- **Poland**. Treatment plants at Gdansk, Gdynia and Szczecin with the inclusion of denitrification capacity in order to reduce discharges of nutrients which encourage algal blooms that are jeopardizing valuable coastal ecosystems and tourist revenues.
- **Lithuania**. The completion of the partially constructed treatment plant at Klaipeda plus support for pre-treatment of industrial wastewater discharged to municipal sewers. This investment together with improvements in nature conservation and coastal management of the nearby Kursiu lagoon will protect an important area for recreation and ecosystems.
- **Latvia**. Rehabilitation and extension of the Liepaja wastewater system, again with provision for pretreatment of industrial wastewater, will protect recreational facilities.
- **Estonia**. Improvements at the Haapsalu wastewater treatment plant can protect the ecologically valuable resources of Haapsalu Bay with its unique curative mud and of Matsalu Bay, a protected area important for migratory birds.
- **Russia**. Investments in the wastewater treatment plants at Kaliningrad and St Petersburg. The current efficiency of the former is so close to zero that the investment will substantially improve the quality of nearby coastal waters and protect the Kursiu lagoon. The overloaded treatment plants in St Petersburg are responsible for 40% of BOD and 50% of phosphorus from all point source discharges to the Gulf of Finland. The project would concentrate initially on collection and primary treatment of untreated discharges and on pretreatment of the industrial wastewater that accounts for nearly 90% of heavy metal discharges to the Gulf of Finland, especially copper and chromium.

In all of these cases, it will be important to phase the expenditures over a considerable period in order to obtain the maximum benefit both domestically and in the Baltic from the resources available. Primary treatment with chemical enhancement will often be the best approach in the short term. Then, as more resources become available, plants can be extended to incorporate various degrees of biological treatment or denitrification.

metals and toxic chemicals pose a more insidious threat to bird and fish, and are reported to have caused serious declines in various species in the Danube and Volga deltas, (though over-exploitation may also have played a part). These concerns reinforce the importance of dealing with emissions of toxic materials from chemical plants as outlined in **Annex 6**.

Among the actions which can be undertaken immediately to support longer term programs for the integrated management of wetlands are to:

- support current measures to protect the Danube and Volga deltas;
- complete inventories of wetlands and assess potential threats to their future health;
- ensure that wetland management is integrated into the broad framework of policies for water management and nature conservation with due account being taken of the scope for multiple use management.

Global Issues

Phaseout of Ozone Depleting Substances

The stratospheric ozone layer shields people, plants and animals from the sun's harmful ultraviolet (UV) rays, and

Box 6.7 The Polish Debt-for-Environment Swap

In 1992, an independent foundation (ECOFUND) was established to manage the funds arising from an agreement by the 17 creditor nations of the Paris Club to swap 10% of Poland's debt for investment in environmental projects. The Paris Club specified that this debt reduction must be based on separate bilateral agreements between Poland and the creditor countries. To date, the United States, France and Switzerland have completed such agreements. The full potential amount of debt that Poland could reduce by this swap mechanism is about US$3.1 billion.

The Polish Government has decided that the swap money should target environmental projects that provide mutual benefits for creditor countries and Poland. These include (i) reducing long-range transboundary air pollutants, (ii) reducing pollution of the Baltic Sea, (iii) lowering emissions of greenhouse gases and phasing-out substances damaging the ozone layer, and (iv) protecting biodiversity.

In its first year of operation, ECOFUND supported 25 projects totalling about US$20 million, including desulfurization of power plant emissions, waste-water treatment plants, and replacement of coal with geothermal energy. ECOFUND finances only the implementation phase of environmental investment projects.

Given the significant size of some of the investments that are being supported by the ECOFUND, the question has been raised whether it does not (i) redirect the investment program away from some of the highest priority domestic environmental problems, and (ii) encourage technologies which may not be most cost-effective in achieving both transboundary and local benefits. The investments may also tie up scarce local resources for long-term operation and maintenance.

In addition to this, Poland has a separate ecoconversion arrangement with Finland, based on a 1990 agreement and administered by the Polish National Fund for Environmental Protection and Water Management. Under this arrangement, financial assistance has been allocated to 28 projects totalling US$12 million.

is a factor in determining the earth's climate. There is a scientific consensus that the protective ozone layer is being depleted by human use of certain chemical agents, particularly chlorofluorocarbons (CFC) and halons. These chemical compounds are used in aerosol propellants, hard and soft foams, refrigeration and air conditioning, industrial solvents, coatings and adhesives, and in materials for fire extinguishing. A reduction in total stratospheric ozone is expected to increase ultraviolet-B radiation at ground levels with adverse consequences for human health and the earth's ecosystems.[7]

The Montreal Protocol of the 1985 Vienna Convention for the Protection of the Ozone Layer now requires phase-outs for the production and consumption of halons by 1994, of CFCs by 1996, and of other ozone-depleting substances (ODS) by 2000. All the main producers and consumers of ODS in the CEE region are Parties to these agreements. Unlike the reduction of emissions of sulfur dioxide or the treatment of sewage, the phase-out of ODS is not a policy which has local benefits that justify much of the cost. The gains are purely global.

Box 6.8 outlines the main issues now facing several CEE countries in their efforts to phase out the use of ODS. ODS use can be eliminated at very low cost from aerosols and flexible foam. Substitute technologies already exist. Scarcity of capital is the key constraint. These projects are not expensive and may be candidates for international funding (on a grant or loan basis) given the potential global environmental benefits. In the technology-intensive sectors (mainly refrigeration), developing non-ODS technologies will be much more difficult. Several companies in CEE have established technology alliances with multinational companies to facilitate access to new technologies.

Governments in Central and Eastern Europe should prepare national recovery-reclamation-recycling strategies to ensure a sufficient supply of refrigerant to maintain the existing stock of capital goods relying on ODS (mainly cooling, air conditioning and refrigeration equipments). Refrigeration appliances have operational lifetimes of an average of 20 years, and during this period, many have to be refilled with refrigerant. Investments in recovering and recycling ODS-refrigerant will avert the need to retire equipment prematurely.

Reduction of Greenhouse Gases

As the energy intensity of production and the share of coal in total energy demand decline in Central and Eastern Europe during the next decade, CEE's emissions of carbon dioxide will fall.

Figure 6.4 shows the projected emissions of carbon dioxide until the year 2010. The Central and East European countries covered by these projections account for a little over 20% of total world emissions of carbon dioxide from industrial sources. Under the main reform scenario (see **Annex 3**), their emissions would fall by 46% in the period up to 2000, so that economic reform in the region should lead to a reduction of 10% of global carbon dioxide emissions from industrial sources. This is equivalent to 80% of the total emissions from the European Union coun-

Box 6.8 ODS Phaseout Activities

Refrigeration

- Support research and development to manufacture refrigerators and freezers using the new HFC-134a compressors, now established as the international standard for domestic refrigeration appliances;
- Develop and implement a CFC recovery and recycling program to help meet the demand for CFC refrigerants for refrigeration applications and air conditioners, including improved servicing and maintenance procedures.

Foam

- Flexible foam. Encourage the development of water-blown foam manufacturing for soft foam products. The use of HCFC or other chemical based blowing agent is not recommended given the cost and production-related health considerations, especially now that most qualities of foam can be produced without using these substances.
- Rigid foam. Introduce the internationally available reduced-CFC foam formulations (which use 50% fewer ODS). Keep abreast of international developments and experiences with HFC and HCFC-blends and with complete water-blown rigid foams.

Aerosols

- Make capital available for production of ODS substitutes.

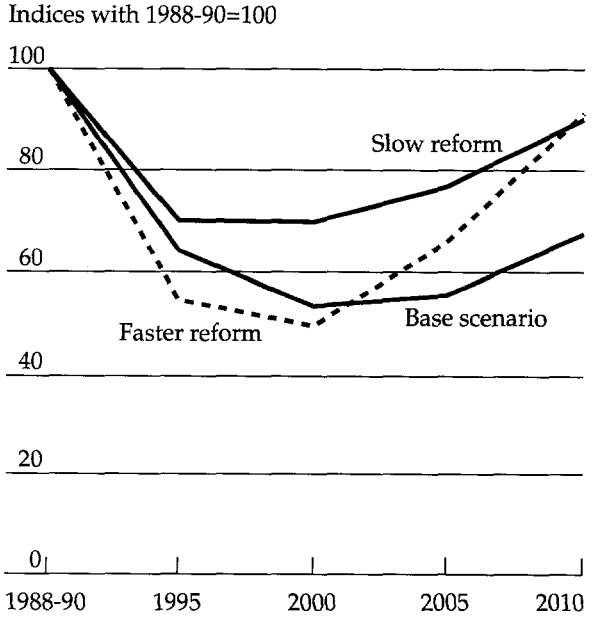
Solvents

- Disseminate technical information to this sector's numerous small users through seminars and demonstration projects. Establish a technical clearing house within industry associations serving the solvent users.

Fire Protection

- Introduce measures to recover and recycle or destroy the large stock of halons which has accumulated over the last few years. Consider participating in the planned international Halon Bank.

Figure 6.4 Emissions of carbon dioxide in Central and Eastern Europe
(total emissions from all countries)



World Bank estimates

tries combined, or to the total emissions from all of the countries in Asia other than China and India. Economic recovery and growth will lead to an increase in emissions after 2000, unless measures are adopted to reduce further the energy-intensity of production and dependence upon coal. The reduction in emissions will, of course, be less if economic reform proceeds more slowly, while faster economic reform enhances the initial decline but leads to higher emissions after 2000 because of the higher rates of economic growth that it permits.

Further reductions in emissions of carbon dioxide and other greenhouse gases, especially methane, could be achieved by collecting the gas associated with oil production rather than flaring it, by minimizing natural gas losses from transmission and distribution systems, and by installing more efficient compressors on gas pipelines. These investments will typically generate high rates of return over and above their environmental benefits. Some projects of this kind are under way or are at the planning stage—primarily in Russia—and the provision of technical assistance to develop more would clearly be justified. There have also been proposals to utilize coal-bed methane resources, especially in Poland and Ukraine. The economic returns to such investments are highly uncertain at present but their potential environmental benefits could warrant the provision of technical and financial assistance to develop pilot schemes.

These changes follow directly from policies and investments that are economically or environmentally desirable for the countries themselves. Further measures to implement the 1992 United Nations Framework Convention on Climate Change would have to be assessed in the context of the limited resources available and the relative priorities attached to other environmental problems—local and transboundary—for which these resources might be used. In the future, reliance upon national taxes on the carbon content of fuels would minimize the economic cost of meeting national targets for reducing carbon dioxide emissions. They would provide direct economic incentives to reduce the use of all fossil fuels by encouraging the development of renewable sources of energy as well as to switch from high to low carbon fuels (i.e. from coal to gas). In addition, an arrangement which allowed countries to trade national emission reduction targets would provide the flexibility required to minimize the overall cost of meeting a fixed target for reducing carbon dioxide emissions over the whole region.

Overall, the marginal cost of reducing emissions of carbon dioxide and other greenhouse gases (GHGs) from countries in Central and Eastern Europe will remain well below the equivalent marginal costs for Western Europe for many years. Internationally as well as nationally, countries should reduce GHG emissions in ways that give the greatest reductions at the lowest cost. For West European countries, that implies using much of the resources devoted to greenhouse warming to reduce carbon emissions from the CEE countries.

Conservation of bio-diversity

There are a number of existing international and regional legal agreements that regulate various aspects of the protection and management of biological diversity, either through protection of species or of ecosystems and habitats. The broadest legal instrument is the convention on Biological Diversity, signed by over 150 States at the time of UNCED. The status of biological resources and diversity of species has traditionally been good in the region because population densities are so much lower than in Western Europe. However, the transition to market economies together with high levels of pollution in some vulnerable areas is beginning to be harmful.

There are various suggestions for immediate actions that can be undertaken to allow countries to fulfil their commitments under the Conventions as well as setting in place the necessary support structures to protect species and habitats. These should be taken in conjunction with the measures discussed in Chapter V as well as the actions in the report on Nature Protection presented to the Lucerne Conference. They include:

- completing inventories of biological resources;
- building up the institutional and human resources required to assess and manage biological resources;
- revising national legislation to conform with the provisions of the Convention on Biological Diversity;
- preparing national strategies for the conservation of biological resources and implementation of the Convention.

Management of Toxic Chemicals and Hazardous Wastes

The concern here is not only toxic chemicals originating in commerce, services, agriculture and industry, but also radioactive substances produced by energy generation, research and medicine and military activities. While the disposal of these wastes is primarily of national concern, it becomes a regional or even global issue when accidents occur, or when wastes are transported across boundaries. Various international agreements regulate the management and transport of hazardous substances, including the 1957 European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR, as amended), the 1986 Convention on Early Notification of a Nuclear Accident; 1986 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency; the 1989 Convention on the Control of Transboundary Movements of Hazardous Wastes (Basel Convention); the 1992 ECE Convention on the Transboundary Effects of Industrial Accidents.

Changes in governance in the region have important implications for the management of hazardous substances. Of particular concern is the rapid loosening of state controls that could result in unregulated transport of hazardous substances across borders.

Immediate actions could be directed to:

- assessment of the state of industrial plants that generate hazardous wastes as well as the related disposal and transport facilities;
- improvement of safety measures, including better institutional, technological, managerial systems and equipment;
- strengthening the institutional and technical capacity to comply with the provisions of the Basel Convention.

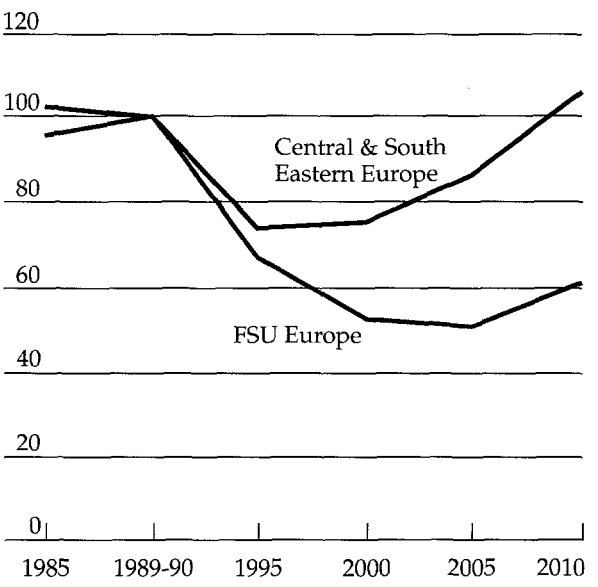
Nuclear issues

The safety of nuclear power plants in the CEE countries is regarded as a matter of both national and international concern. Work so far supported by international donors has been mainly limited to assessments of the need for improvements to operating safety.

The 1992 Munich G-7 Summit adopted a multilateral program to improve operational safety, make immediate technical improvements to plants based on safety assessments, and enhance regulatory regimes. In addition, the program will create the basis for longer-term safety improvements by examining the scope for replacing less safe plants with alternative energy sources and more efficient use of energy, and the potential for upgrading plants of more recent design. The Summit extended the existing G-24 Coordination mandate to the new States of the former Soviet Union and proposed the setting up of a supplementary multilateral mechanism to provide for financial support for immediate measures not covered by bilateral programs.

The period of economic stabilization and transformation provides a good opportunity to put sound long term energy policies into place and to develop non-nuclear sources of electricity supply. **Figure 6.5** shows that primary energy demand in both Central and South-Eastern Europe and the former Soviet Union is projected to decline by more than 20% from 1989/90 to 1995 and will not rise significantly before 2000. Electricity demand will grow as a share of total energy demand, but it is unlikely to recover to pre-reform levels in any country much before 2005.

Figure 6.5 Primary energy use in Central and Eastern Europe



Conclusions: The Key Messages

Given their limited resources, the countries of Central and Eastern Europe need to give priority to those environmental measures which promise the greatest gains at the lowest cost. Generally speaking, such measures will be primarily local in their impact, because the average concentration is greatest near the point(s) of emission.

However, many such measures will also have beneficial side effects on those kinds of pollution whose impacts cross borders. When designing policies that bring local benefits, it will be important to bear in mind the possibility of making simultaneous improvements to reduce cross-border or global environmental damage.

Where the costs of mitigating transboundary environmental damage exceed the local benefits, it is reasonable for CEE countries to ask their richer neighbors for assistance. From the point of view of West European countries, there may sometimes be greater gains to be had from spending money on reducing sources of pollution in Eastern Europe than by spending it at home, where standards are already high. This principle is likely to hold in areas as diverse as global warming, nuclear safety and river quality.

Box 6.9 Global Environment Facility Biodiversity Projects in Central Europe

Country	Project Areas & Ecosystems	Adjoining Projects	Specific Innovations
Belarus	• Byelovezhskaya forest • Berezinsky wetlands • Pripyatsky forest	• Poland GEF • Poland Forestry (World Bank supported)	Conservation planning and research outreach programs
Ukraine	• Carpathians Biosphere Reserve forests and alps	• Poland GEF • Slovak GEF	Management of forest fragments and introduction of wildlife corridors and land use planning for biodiversity protection
Slovak Republic	• Morava floodplain forests and wetlands • Tatras forests and alpine meadows • Eastern Carpathians forests and meadows	• Ukraine GEF • Poland GEF • Poland Forestry (World Bank supported) • Austrian Eco-Fund Activities	Environmental NGO Small Grants Program; development of tri-national trans-border Trust to maintain coordinated management of the international biosphere reserve in the Eastern Carpathians
Czech Republic	• Palava wetlands and floodplain forests • Sumava forests • Krkonose alps and forests	• Slovak GEF • Poland GEF • Poland Forestry (World Bank supported) • Austrian Eco-Fund • FACE project at Krkonose	Environmental NGO Small Grants Program and improved wildlife management; establishment of revenue mechanisms and use of economic measures to maintain use below determined ecological carrying capacities
Poland	• Bialowieza primeval forest • Sudety forests	• Ukraine GEF • Czech GEF • Slovak GEF	Establishment of a gene bank to protect genetic diversity at risk because in-situ conservation is not possible due to pollution.

The synergy that exists between reducing domestic and transboundary pollution may sometimes dictate domestic priorities. Policies whose gains arise both in a CEE country and beyond its boundaries may not be economic if considered in purely national terms. But, by persuading neighboring countries that they will also enjoy some of the gains from such policies, and securing a contribution from them towards the cost, CEE countries may find that measures with domestic benefits become more affordable.

Notes

1. The United States has introduced a system of tradeable permits for large and medium sources in the Clean Air Act Amendments of 1990. In principle, this system could be extended to small scale sources by requiring that fuel suppliers must acquire permits to cover the estimated emissions of small scale consumers of gasoline, heating oil or coal. Emissions trading in the U.S. is gradually beginning to be a well-accepted process in the power sector and is expected to result in substantial resource savings and additional industrial growth.

2. London Economics, *The Potential Role of Market Mechanisms in the Control of Acid Rain.* Environmental Economic Research Series (Department of the Environment, London, HMSO: 1992).

3. The European Union's Large Combustion Plant (LCP) directive sets stringent targets for reducing emissions of SO_2 and NO_x from large sources. The policies for implementing the directive vary across countries but effectively all new and many existing large plants (> 300 MW) will be required to install flue gas desulfurization or in-furnace sulfur controls plus low NO_x burners and selective catalytic reduction if they are to continue operating into the next century.

4. • the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention), as amended;
   • the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL);
   • the 1974 and the 1992 Helsinki Conventions on the Protection of the Marine Environment of the Baltic Sea Area;
   • the 1976 Barcelona Convention for the Protection of the Mediterranean Sea against Pollution, with its related protocols;
   • the 1990 International Convention on Oil Pollution Preparedness, Response and Cooperation;
   • the 1992 Bucharest Convention on the Protection of the Black Sea against Pollution, with its related protocols.

5. A large portion of nitrogen compounds is converted sooner or later to nitrate which is persistent and not easily removed. "Self-purification" is therefore less effective in assuring the quality of drinking water resources—a problem which is compounded by the inability of existing water treatment plants to cope with nitrate contamination. There may also be local problems with phosphorus which can cause high algae biomass if light conditions are favorable and the flow is slow. Existing wastewater treatment facilities cannot cope with this problems.

6. For example, Bulgaria and Greece are considering the possibility of establishing a system which would monitor discharges into rivers that flow from the Balkan and Rhodope Mountains into the Mediterranean, including the Maritsa and Struma Rivers which are among the most polluted in Bulgaria.

7. *Human health:* Increases in non-melanoma skin cancer and cataracts, and in the incidence or severity of infectious diseases due to suppression of human immunological systems.

Ecosystems: Reduction in the numbers of phytoplankton, and inhibited growth and photosynthesis of certain plants.

Chapter Seven

Principal Recommendations

This chapter draws together the main themes of the report. Nine ***key messages*** *stand out:*

(i) Countries have many opportunities to implement policies and invest in projects which provide both economic and environmental benefits. "Win-win" policies include removing subsidies that encourage the excessive use of fossil fuels and water in industry, agriculture and households. They also include investments in energy and water conservation, low-input and low-waste technologies, and expenditures on "good industrial housekeeping."

(ii) Environmental priorities should be based on a careful comparison of costs and benefits. The resources available for environmental improvements will be severely constrained in Central and Eastern Europe for at least the next 5–10 years. It is essential that limited resources be applied to the most urgent problems first.

(iii) Market forces should be harnessed to control pollution wherever possible. Market-based instruments, such as pollution charges, fuel taxes, and deposit refund schemes, can help achieve desired levels of environmental quality at much lower costs than traditional regulatory approaches. Regulatory instruments will still be needed to control emissions of micro-pollutants such as heavy metals—particularly lead—and toxic chemicals.

(iv) Countries should concentrate on local problems first. Many people suffer health damage from exposure to lead in air and soil, airborne dust and sulfur dioxide, from nitrates in drinking water and from contaminants in water and food. Solving these problems will bring the biggest gains in health and well-being. Measures to reduce emissions of pollutants in response to local concerns should also contribute to reducing transboundary and global emissions.

(v) Standards need to be realistic and enforceable. Countries should implement stricter standards over a 10–20 year period, and ensure that industries comply with interim standards. Local people should be involved in setting priorities and in implementing solutions. Neither governments nor donor institutions are equipped to judge how local inhabitants value their environment. A participatory approach is essential for the long-run sustainability of environmental improvements.

(vi) Responsibility for past environmental damage needs to be clarified. Uncertainty about who will be responsible for past damage can discourage foreign and domestic investment and can impede privatization. For practical reasons, governments will have to bear most of the costs of dealing with past pollution. Governments must define clearly the environmental standards that new owners must meet and the period of adjustment that will be permitted.

(vii) Donor countries should consider providing funding to accelerate the reduction of transboundary and global emissions in countries of Central and Eastern Europe. Such funding would be particularly appropriate where the marginal cost of reducing emissions is lower in Central and Eastern Europe. Minimizing the net cost of meeting international agreements is in the interests of individual countries and Europe as a whole. If the net cost of reducing transboundary flows is lowered, countries will be able to afford to act earlier or to adopt more stringent targets.

(viii) More research, training, and exchange of information are needed to help decision-makers set sensible priorities. Research should focus on the state of the particular environment of Central and Eastern Europe. Much more information is also needed on low-cost ways to reduce emissions of air and water pollutants from non-ferrous metal smelters, iron and steel plants, chemical plants, paper mills, and wastewater treatment plants and on ways to conserve biodiversity.

(ix) Finding, implementing, and financing solutions will require building partnerships. Transferring know-how and clean technologies will require strong cooperation between East and West, between countries of Eastern and Central Europe, and within countries, between cities, institutions, and enterprises.

Priorities in Detail

What governments must do

IMPROVE STANDARD-SETTING.

- Adopt a framework of environmental standards that allows for a gradual tightening over a 20–30 year period, and enforce interim standards;
- Adopt a realistic set of ambient standards which can be easily monitored and enforced;
- Do not set uniform emission standards at a country-wide level. Allow for substantial variation in emissions at different locations and sources. Set the most stringent requirements—such as the adoption of Best-Available Control Technology—for hot spots where economic transformation and capital replacement will not bring ambient concentrations of criteria pollutants down to acceptable levels.

CLARIFY ENVIRONMENTAL LIABILITY.

- Clarify responsibility for past environmental damage. Uncertainty about who will be responsible for past damage can discourage foreign and domestic investment in heavy industries and impede privatization. For practical reasons, governments will have to bear most of the costs of dealing with past emissions. Governments must define clearly the environmental standards that new owners must meet and the period of adjustment that will be permitted;
- Establish a monitoring system to make it possible to distinguish between damages caused by past pollution and current emissions; define the environmental standards that privatized firms will be required to meet and the adjustment period to be permitted;
- So as not to delay privatization, limit full environmental audits to a small number of the largest firms. Set aside a portion of privatization proceeds to pay for any clean-up subsequently required.

USE THE MARKET.

- Reduce energy subsidies, providing transitional assistance if necessary for households or industries disproportionately affected;
- Choose market-based instruments for pollution control wherever possible, building on existing frameworks of pollution charges. These can help achieve desired levels of environmental quality at much lower costs than traditional regulatory approaches. Regulatory instruments will still be needed to control emissions of micro-pollutants such as heavy metals and toxic chemicals. In some regions, tradeable permits may be appropriate.

REORGANIZE PRIORITIES FOR PUBLIC SPENDING.

- Design and select public investments to accelerate the impact of industrial restructuring on the environment and to reinforce market incentives for economic change;
- Provide funding to cover the operational, maintenance and repair costs of existing public environmental services, especially the treatment of drinking water and sewage, the collection and disposal of municipal waste, and maintaining inventories—and monitoring the disposal—of hazardous, toxic and nuclear wastes;
- Invest in "win-win" projects which can be justified on economic grounds alone but which bring substantial environmental benefits. These include improvements in energy efficiency, water conservation, the adoption of low input and low waste technologies, and minor plant improvements which facilitate "good housekeeping;"
- Provide funding for training, internship and exchange programs, for the development of environmental education curricula, and for other activities which raise local capacity for effective decentralized decision making;
- Publicize how improvements in management and operating practices can achieve environmental improvements with existing plant and equipment;
- Require existing large sources to improve their environmental performance. This strategy will yield most of the benefits derived from an attempt to achieve lower emissions for all sources, large or small, but at much lower cost;
- Aim for larger reductions in emissions of particulates, air-borne lead and heavy metals than for sulfur dioxide or nitrogen oxides since it is much less expensive to control emissions of the former than the latter;
- Require all non-ferrous metallurgy and parts of the chemical industry to reduce or eliminate their discharges of heavy metals—particularly lead—to air and water.

GIVE PRIORITY TO THE FOLLOWING PUBLIC INVESTMENTS.

- Invest in measures to reduce emissions from low stacks in urban areas where home heating is a significant contributor to high ambient concentrations of particulates and sulfur;
- Install dust collection systems and filters to non-ferrous metal smelters—particularly lead, zinc, and aluminum plants—which are located 5 km upwind of significant centers of population;
- Install equipment to reduce emissions of dust, smoke, and soot, and carbon monoxide from iron and steel plants, especially those relying on open hearth furnaces;
- Make investments to replace coal with gas or to permit the burning of smokeless solid fuels in district heating plants, commercial enterprises and households in towns and cities where the average ambient concentrations of particulates exceeds 150 micrograms per cubic meter;
- Invest in facilities to pre-treat the wastewater discharged by small and medium-sized industrial plants where contamination of groundwater and rivers by heavy metals is a significant problem—for example in towns and cities with a concentration of tanning, electro-plating and other metalworking plants;
- Facilitate the installation of domestic septic tanks and the appropriate disposal of manure from intensive livestock operations in rural areas where levels of nitrates in drinking water drawn from shallow wells typically exceed 10 mg of nitrate-N per liter;
- Ensure that the disposal of domestic, toxic, nuclear and other hazardous wastes is carefully monitored and that leachates from disposal sites do not contaminate ground or surface waters, especially sources used for the abstraction of drinking water supplies;

• Install municipal wastewater treatment plants in towns and cities close to important tourist or wildlife areas, especially on the Adriatic, Baltic and Black Sea coasts, Lake Balaton, the Mazurian Lakes and the Carpathian and Rhodope Mountains;

• Complete partially constructed wastewater treatment plants either in the upstream sections of seriously polluted rivers or where the bacteriological quality of water downstream of major towns and cities is particularly poor;

• Implement sustainable rural development projects in defined areas of high biodiversity and great ecological importance that are under threat. Such projects should combine better management of protected areas with ecologically benign agricultural/forestry, tourism and other activities.

What enterprises must do

• Invest in mitigating discharges of saline water from mines in countries such as the Czech and Slovak Republics, and Poland, provided that the costs of such investments are recovered over the long run from the mines responsible for salt water emissions;

• Provide industrial wastewater treatment facilities in plants—for example in the textile and pulp and paper industries—which discharge heavy loads of BOD and other pollutants into receiving waters that are relatively clean and that lie upstream of major centers of population;

• Install equipment to reduce leakages of heavy metals, toxic gases and discharges of toxic wastes—to the air, in wastewater or in solid wastes—from petrochemical and other chemical plants, especially those located close to substantial towns and cities.

What government must do to address longer-term environmental problems

• Establish vehicle testing stations combined with facilities for better vehicle maintenance in order to enforce reasonably strict emission standards for the commercial diesel vehicles—buses and trucks—which are the principal mobile source of particulate emission;

• Develop a program to phase out leaded gasoline. Require that new vehicles (automobiles, buses and trucks), from some appropriate future date, meet the emission standards laid down by the EU. Most of the cost of these measures will be borne by refineries, automobile manufacturers and their customers, but resources for technical assistance and to deal with special transitional problems would speed up the implementation of these programs;

• Fund applied research into a number of environmental problems for which solutions may be very costly (*e.g.*, treatment of nitrate pollution) or where implementation of remedies has been difficult. Such research could focus on ecologically acceptable agriculture and forestry practices—especially their economic costs and benefits. Support could also be channelled to specialized research institutions engaged in crucial conservation (*e.g.*, botanical gardens); and to undertake well-defined studies on the ecological damage caused by large-scale development projects such as dams, canals, and major tourism developments;

• Strengthen the collection and dissemination of data on the state of the environment and natural resources.

Transboundary issues

ACID AIR POLLUTION.

• Combine local and transboundary concerns. Implementing good economic and environmental policies in response to local concerns will do much to reduce transboundary emissions;

• Choose market-based instruments—such as pollution charges or tradeable permits—to minimize the costs of meeting international agreements;

• Provide a framework which allows groups of countries who might each benefit from cooperation to share the burden of achieving larger reductions in emissions than would be warranted on purely domestic grounds. In particular, donor countries might consider arrangements by which they contribute to the incremental costs of meeting stricter or earlier targets for emissions reductions in Central and East European countries.

PHASEOUT OF OZONE DEPLETING SUBSTANCES.

• In the short term, focus on the aerosol and flexible foam sectors where ODS use can be eliminated at very low cost;

• To facilitate access to new technologies in the technology-intensive sectors (mainly refrigeration), encourage companies in CEE to establish technology alliances with multinational companies;

• Prepare national recovery/reclamation/ recycling strategies to ensure a sufficient supply of refrigerant to maintain the existing stock of capital goods relying on ODS (mainly cooling, air conditioning and refrigeration equipments).

REDUCTION OF GREENHOUSE GASES.

• Collect the gas associated with oil production rather than flaring it, minimize natural gas losses from transmission and distribution systems, and install more efficient compressors on gas pipelines to reduce emissions of carbon dioxide and other greenhouse gases, (especially methane), beyond what will occur as a result of economic reform. These investments will typically generate high rates of return without taking any account of their environmental benefits;

• Use market-based instruments—such as carbon taxes—wherever possible to reduce emissions of greenhouse gases. Encourage the development of an arrangement which allows countries to trade national emission reduction targets;

• In the European context, West European countries could make the best possible use of their resources devoted to greenhouse warming by allocating a substantial fraction to reducing energy use and carbon emissions from the CEE countries.

TRANSBOUNDARY WATER POLLUTION.

• Install treatment technologies in coastal centers which remove more nitrogen and, perhaps, phosphorus than those which would be appropriate on the basis of local considerations alone when transboundary effects are important. International assistance would be appropriate for those countries in Central and Eastern Europe which border on international seas threatened by transboundary pollution;

• Concentrate on downstream sources during the initial stages of tackling the problem. This implies a two-pronged strategy of focusing domestic resources on improving upstream water quality while external resources are directed towards downstream sources which have the most direct impact on the sea concerned;

• Develop the framework of cooperation needed to take stronger action in the future if justified, including:

(i) gathering information on water pollution affecting shared water resources to determine the most cost-effective control measures for controlling pollution;

(ii) developing systems to collect and exchange information about trends in water quality and emissions;

(iii) coordinating across countries water policies and regulations affecting shared water basins—including, if appropriate, a joint water basin management agency responsible for implementing cooperative programs.

WETLAND MANAGEMENT.

• Support current measures to protect the Danube and Volga deltas;

• Complete inventories of wetlands and assess the status of resources which they offer and the potential threats to their future health;

• Ensure that wetland management is integrated into the broad framework of policies for water management and nature conservation with due account being taken of the scope for multiple use management.

CONSERVING BIO-DIVERSITY.

• Complete inventories of biological resources;

• Build up the institutional and human resources required to assess and manage biological resources;

• Revise national legislation to conform with the provisions of the Convention on Biological Diversity;

• Prepare national strategies for the conservation of biological resources and implementation of the Convention.

MANAGING TOXIC CHEMICALS AND HAZARDOUS WASTES.

• Assess the state of industrial plants and activities that generate hazardous wastes as well as the related disposal and transport facilities;

• Improve safety measures, including through institutional, technological, managerial systems and equipment;

• Strengthen the institutional and technical capacity to comply with the provisions of the Basel Convention.

Reforming Institutions

THE KEY PRIORITIES.

• A clear government commitment and environmental objectives set in the context of a broad participatory approach is a fundamental prerequisite for longer-term successful environmental policy.

• Donors should make greater use of local expertise. Not only would this help to develop local skills, it can also provide a better understanding of local circumstances and be more cost-effective then using experts from donor countries. Donors should address the problem of tied aid.

• Environmental objectives should be based on realistic assumptions about the availability of financial and human resources.

• Much more emphasis should be placed on the front-end of the project cycle, (i) establishing objectives; (ii) identifying efficient solutions among a range of institutional, policy and technological options; (iii) and identifying what is needed for successful implementation.

• Be cautious in developing comprehensive environmental laws; the rapid political and economic changes may make them difficult to implement.

• Integrate environmental concerns in the economic reform laws wherever possible.

STRENGTHENING INSTITUTIONAL CAPACITY.

• To build a local environmental management capacity and establish appropriate coordination mechanisms, CEE countries should: (i) clarify roles and responsibilities for environmental management among national, regional and local levels; (ii) strengthen co-operation between municipalities to overcome administrative fragmentation; the environmental divisions of local authorities sharing a particular environmental system (*e.g.* a watershed or an "airshed") need better horizontal links; (iii) increase efficiency of municipal services with significant environment impact such as water, district heating, solid waste management and urban transport; (iv) strengthen environmental planning, project preparation and financial management capacity at the local level.

• Institutions that manage river basins should be created or strengthened and given appropriate autonomy. They need finance.

• CEE countries should share experience and know-how through, for instance, the Regional Environment Center.

STRENGTHENING ENVIRONMENT MINISTRIES.

• Environment ministries should emphasize policy and coordination, rather than implementation, which is better left to regional and local institutions. They should build a close working relationship with ministries of health, which have often have been responsible for ambient environmental monitoring, to establish the vital link between health objectives and environmental policies and investments.

• Bilateral donors should facilitate the secondment of CEE country experts in western institutions (and western experts should be made available to assist in Central and Eastern European environment ministries). Such secondments would be especially useful for cross-sectoral issues, and for designing effective legislation and implementation procedures and for helping to upgrade economic analysis and other techniques to support decision-making.

• Improve cooperation between ministries, perhaps by setting up cabinet-level committees for environment and

development, and by designating staff from the ministry of environment to participate in strategy development in all sectoral ministries.

IMPROVING MANAGEMENT CAPACITY, TRAINING AND EDUCATION.

- CEE countries should design and implement educational training programs for high-level decision-makers at national and local levels, in close collaboration with local institutions. Training programs could be supported by voluntary contributions from donors, with CEE countries providing the on-site organization and support.
- CEE countries should establish a network of national institutions involved in environment training. The purpose of the network would be to promote exchange of information between those institutions and their counterparts in other countries, and with external financial partners.
- All bilateral and multilateral assistance projects with a direct impact on the environment should include some environmental training.

IMPROVING ENVIRONMENTAL MONITORING AND INFORMATION SYSTEMS.

- Expand gradually environmental information systems in accordance with priorities and resource availability. As resources become available, expand coverage of: (i) water quality parameters (*e.g.* biological indicators, phosphorus and heavy metal levels); (ii) marine discharges; (iii) pesticide use; (iv) ambient air concentrations of carbon monoxide, hydrocarbons, and lead; (v) exposure to noise from traffic, airports and other sources; (vi) wastewater treatment, including the numbers of households connected to sewage systems, capacity of treatment systems and degree of treatment prior to disposal; and (vii) volumes and sources of solid waste and hazardous waste.
- Extend monitoring networks, comparability and reliability of the data collected. Replace costly census methods with sample surveys.
- Strengthen links between CEE countries' environmental information systems and international systems.
- Promote self-monitoring of enterprises, with random spot-checks by the authorities. Consider making the future frequency of monitoring or spot-checks depend on the past record of compliance (*e.g.*, sources found in violation twice in a row could be put on a watch list for frequent audits). With appropriate penalties for violations, it has been demonstrated that high rates of compliance are possible even with tight budgets.
- Give priority to monitoring areas with the highest ambient levels of pollutants which damage human health, even if it means transferring air and/or water pollution monitoring stations from other parts of the country.

STRENGTHENING NON-GOVERNMENTAL ORGANIZATIONS

- Encourage authorities and business to recognize the role and importance of environmental NGOs as full participants in the public debate about sustainable development and the formulation and implementation of practical policies. Invite NGOs to the relevant advisory boards, delegations, negotiations, etc. Western governments, multinational institutions and western business should recognize CEE NGOs as regular discussion partners for their activities in and related to the region.
- Provide NGOs with access to environmental information and permit their participation in environmental impact assessments. Consider following U.S. legislation and practice concerning access to information, and Dutch legislation and practice concerning environmental impact assessment.
- Consider providing financial support to NGOs.

Implementation

ASSISTANCE PRIOR TO INVESTMENT.

- CEE countries should clearly specify commitments to policy reform and structural change that affect the viability of a project.
- CEE countries should better design feasibility studies. The terms of reference for such studies should address not only the technical case for investment, but also the often neglected financial and institutional requirements for implementing the project over time. Donors should involve international financial institutions when preparing terms of reference.

PROGRAM MANAGEMENT.

- CEE countries should undertake programs in an integrated manner in support of long term country and regional strategies, not as an aggregation of individual projects, and should establish effective program and project management procedures.

STRENGTHENED COORDINATION.

- The key functions of coordination should be: (i) to monitor whether priority issues are being addressed in investment and technical assistance programs; (ii) to stimulate corrective actions when priority needs are not being addressed; (iii) to put CEE countries with a particular need for assistance in touch with potential providers of assistance; (iv) to help avoid duplication of effort by collecting and effectively disseminating information on assistance activities; (v) to review and share experience gained, both by donors and recipients.

THE PRIVATE SECTOR.

- Provide clear "rules-of-the-game" for the private sector in order to attract foreign investment and remove uncertainty for business. In developing national strategies, give priority to clarifying environmental liability issues and establishing appropriate Environmental Impact Assessment procedures. Western donors should support the development of the local environmental services sector.
- Encourage companies to use *The Budapest Guiding Principles on Environment, Industry and Investment Decisions in Central and Eastern Europe* for guidance with regard to the environmental dimension of investment. This may facilitate the transfer of technology and know-how.

REVIEW OF IMPLEMENTATION.

- All countries concerned should report periodically on adaptation and implementation of the EAP. NGOs can be encouraged to contribute to this effort.
- In monitoring the State of the Environment in Europe, the European Environment Agency should take account of environmental trends in "hot spots" or critical regions identified in the EAP and national strategies.
- Establish a mechanism to enable the EAP to function as a "living document", elaborating key elements of the strategy and providing feedback on the original strategy.

PROMOTE DEVELOPMENT OF NATIONAL ENVIRONMENTAL ACTION PROGRAMS.

- CEE countries should take the lead in developing environmental action programs specific to their needs and the environmental problems they face. This process should start with a clear agreement on priorities among all interested parties in the country. Efforts should then concentrate on choosing the most cost-effective way to achieve the desired objectives within the given financial and institutional constraints.

Annexes

Annex One

Summary of Human Health Problems and Major industrial plants located in pollution "hot-spots" in Bulgaria, Czech and Slovak Republics, Hungary, Poland, Romania; Latvia, Lithuania, Estonia; Belarus, Ukraine, and European Russia

This summary outlines those environmental health problems in Central and Eastern Europe for which reasonably credible epidemiologic data are available. It is meant to be a comprehensive summary, but there are obstacles to achieving this goal. Health outcomes in the various regions with similar chemical exposure problems have not necessarily been investigated to an equal degree, and different methodologies of varying credibility have been used. This is particularly a problem for chronic and multifactorial diseases which require advanced epidemiologic methods that are not commonly understood in Eastern Europe. Thus, the following summary draws attention to those chemical exposure problems which have been adequately studied, but does not mean to imply that other, well recognized episodes of environmental pollution or degradation have not led to human health problems.

The problems described here are primarily the result of exposures to lead in air and soil, airborne dust, sulfur dioxide and other gases,[1] and nitrate in water.

1 **Places where there is a problem with *overexposure to lead among children*** (37 locations in 7 countries):

This problem is important because it may lead to neurobehavioral deficits which will have long term effects on children's educational attainment. Evidence of neurobehavioral deficits among exposed children has been found in several of the following places:

(a) **Poland.** Katowice Wojewodship—Szopienice, Miasteczko, Zyglin, Lubowice, Zabrza, Toszek, Bytom, Bojszow, Brzeziny, and Brzozowice.
Legnica-Glogow area—near copper smelters (note: quality control problems with blood lead data).
(b) **Czech Republic.** Central Bohemia—Pribram (note: quality control problems with blood lead data).
(c) **Hungary.** Inner Budapest, Romhany, Szolnok.
(d) **Bulgaria.** Plovdiv, Asenovgrad, Kuklen, Kurdzhali (results of lead studies of adults in Voden, Kremikovtsi, Jana and Pernik imply that there are probably overexposures to children, too).
(e) **Romania.** Bucharest, Copsa Mica, Baia Mare (probable).
(f) **Russia (European).**[2] St. Petersburg, Berezniki, Podolsk, Yaroslavl, Samara, Nizhnyy Novgorod, Ulyanovsk, Rostov-na-Dony, Kursk, Astrakhan.
(g) **Ukraine.** Kostiantynivka (probable).

2. **Places where there are documented associations between *acute respiratory diseases* (sinusitis, pharyngitis, bronchitis and laryngitis) and air pollution** (46 locations in 10 countries):

(a) **Poland.** Kraków.
(b) **Slovakia.** Bratislava.
(c) **Czech Republic.** Central Bohemia— Neratovice, Kralupy.
North Bohemia— Usti nad Labem, Teplice, Most, Chomutov, Decin.
(d) **Hungary.** Dorog, Ajka.
(e) **Bulgaria.** Ruse, Vratsa, Devnya, Srednogorie, Krekikovtsi, Asenovgrad, Shvistov, Dimitrovgrad, Sofia, Gabrovo, Varna, Kameno, Burgas.
(f) **Estonia.** Narva/Kohtla-Jarve/Sillamae area, Kunda.
(g) **Lithuania.** Jonava, Kaunas.
(h) **Latvia.** Olaine.
(i) **Romania.** Slatina, Baia Mare, Tasca, Sendreni-Galati, Savinest, Suceava, Hunedoara, Mintia, Otelul Rosu, Navodari, Remicu-Vilcea.
(j) **Russia (European).** Arkhangelsk, Berezniki, Voskresensk, Cheboksary, St. Petersburg.
(k) **Ukraine.** Zaporizhzhia.

1. There is a need to carefully review the places with environmental health problems due to airborne exposures to evaluate the relative importance of gaseous exposures *in the absence of dust*.

2. This and the following information on European Russia is preliminary and subject to verification.

3. **Places where there are documented associations between *chronic respiratory diseases* (chronic bronchitis/emphysema and asthma) and air pollution** (29 locations in 9 countries):

   (a) **Poland.** Regional association between SO_2 levels and chronic bronchitis and asthma rates throughout the country; also found specifically within Kraków.
   (b) **Czech Republic.** North Bohemia—Usti nad Labem, Teplice, Most, Chomutov, Decin.
   (c) **Hungary.** Dorog, Ajka, Nagyteteny (in District 22 of Budapest), Borsod County (especially Karincbarcika and Miskolc).
   (d) **Bulgaria.** Ruse, Razlog, Vratsa, Devnya, Srednogorie, Plovdiv, Asenovgrad, Kremikovtsi, Pernik.
   (e) **Estonia.** Narva/Kohtla-Jarve/Sillamae area, Kunda.
   (f) **Lithuania.** Jonava, Kaunas.
   (g) **Latvia.** Olaine.
   (h) **Russia (European).** Sterlitamak, Ufa, Chaykovskiy (Perm oblast).
   (i) **Romania.** Turda, Copsa Mica.

4. **Places where there is reasonably strong evidence of a connection between excess infant and lung cancer *mortality* and air pollution** (8 locations in 3 countries):

   (a) **Poland.** Katowice—infant mortality in areas with the highest dust levels.
   Kraków—Lung cancer in relation to community exposures to steel mill emissions.
   (b) **Czech Republic.** Infant mortality (especially post-neonatal respiratory mortality) in regions with the highest dust and SO_2 levels.
   (c) **Russia (European).** Berezniki, Nizhnyy Novgorod, Dzerzhinsk, St. Petersburg, Lipetsk.

NB: Other places where correlations between air pollution and adult mortality and/or cancer incidence are likely valid, but require further investigation, include the mining districts of North Bohemia (lung cancer, all cancer, total mortality), the most polluted districts of Central Bohemia (total mortality), Ziar nad Hronom region of Slovakia (total mortality), Lódz (total mortality) and the mining district of southern Bulgaria (lung cancer).

5. **Places where there are documented associations between *abnormal physiological development* and air pollution** (18 locations in 7 countries):

   (a) **Poland.** Kraków—reduced pulmonary function among adult males exposed to acid rain emissions.
   Katowice—average hemoglobin levels among mothers and children reduced by about 20% below normal.
   (b) **Czech Republic.** Rates of low birth weight are increased in the regions with the highest levels of dust and SO_2.
   Central Bohemia
   — increased rates of "small for gestational age" babies in the regions with worst environmental quality.
   — reduced pulmonary, hematological, and immune function in children from most air polluted areas.

   Mining Districts of Bohemia
   — reduced hematological and immune function in children.
   — delayed bone maturation in children.

   Teplice and Usti nad Labem, North Bohemia
   — increased rates of congenital anomalies.

   (c) **Hungary.** Nagyteteny—anemia among children.
   Ajka—reduced pulmonary function among children.
   (d) **Bulgaria.** Dimitrovgrad—reduced pulmonary function and reduced growth rates among children.
   (e) **Estonia.** Narva/Kohtla-Jarve/Sillamae area—reduced hematological and immune function in children.
   Kehra—reduced pulmonary function among children.
   (f) **Romania.** Slatina, Copsa Mica, Turda—reduced pulmonary function among children.
   Copsa Mica, Baia Mare—growth retardation.
   (g) **Ukraine.** Mariiupil, Zaporizhzhia—increased rates of congenital anomalies.

6. **Places where *nitrates in drinking water* are widespread, requiring water replacement to protect newborns against *methemoglobinemia*** (Widespread in 6 countries):

   Methemoglobinemia is a form of chemical asphyxia wherein the oxygen carrying capacity of the blood is chemically inhibited by nitrates:

   (a) **Slovakia.** Widespread problem.
   (b) **Hungary.** Borsod County—widespread problem.
   (c) **Bulgaria.** Districts of Haskovo, Burgas, Varna, Razgrad and Lovech—widespread problem. Also in Stara Zagora, Pazardgik Targovichte.
   (d) **Belarus.** Brest, Gomel, Grodno, Vitebsk, Minsk, Mogibv oblasts.
   (e) **Lithuania.** One-third of country covered by water replacement program for pregnant women.
   (f) **Romania.** Widespread problem throughout the country.

7. **Places with problems with *arsenic*:**

   (a) **Slovakia.** Ziar nad Hronom—increased rates of non-melanoma skin cancer and hearing loss in children downwind of the aluminum plant.
   (b) **Hungary.** Békés County—high levels of arsenic in the water supply, with evidence of arsenic-related

skin conditions and intestinal colic among children, as well as a possibility of increased rates of stillbirths and spontaneous abortions.

(c) **Bulgaria.** Srednogorie—increased levels of arsenic in surface water and in the soil.

(d) **Romania.** Arad-Lipora-Ineu districts—area is contiguous with Bekes County, Hungary. High rates of skin cancer have been found here.

(e) **Russia (European).** Cherepovets, Kamensk-Shakhtinskiy (Rostov oblast), Tyrnaua (Kabardino-Balkariya), Vladikavkaz.

8. **Other Health Effects of *Contaminated Drinking Water Supplies*:**

(a) **Latvia.** Riga—large waterborne hepatitis A outbreak
Jelgava—large milk-borne dysentery outbreak based on contaminated water supply.

(b) **Romania.** —carcinogenic substances exceeding standards have been measured in water samples from 32 of 41 districts in the country.
—chlorinated pesticides found in many water supplies around the country.

(c) **Russia (European).** St Petersburg, Murmansk, Volograd, Kurgan, Novgorod oblast, Mordovian Republic.

9. **Places with *other problems*:**

(a) **Poland.** Kraków—ongoing problems with fluorosis near an aluminum smelter.
Turow, Silesia—high prevalence of methemoglobinemia near lignite power plant.

(b) **Slovakia.** Michalovce—PCB exposures, with mini-epidemic of Potter's Syndrome (congenital agenesis of kidneys) in the late 1970s.

(c) **Belarus.** Gomel oblast—thyroid cancer in children following Chernobyl.

(d) **Estonia.** Widespread beach closures to protect against the spread of infectious disease.

(e) **Latvia.** Water supply in Daugavpils closed twice in the last two years to protect against chemical spills upstream on the Daugava River in Belarus.
Brocenai—large-scale community asbestos exposure.
Liepaja—multiple concerns from electromagnetic radiation from radar stations.
Olaine—disordered immune function in adults.

(f) **Romania.** Several towns/cities with high airborne asbestos levels.
Suceava—neurological symptoms in children exposed to carbon disulfide.

(g) **Russia (European).** Kalingrad, Novgorod, Lepetsk, Syktyrkar, Kandalaksha, Cherepovets—high airborne benzo(a)pyrene levels.
Dzerzhinsk, Serpukhov—High levels of polychlorobiphenyls in air, soil, water, vegetation, and breast milk.
Ufa, Shchelkovo, Chapayevsk, Dzerzhinsk, Moscow, Murmansk—high concentrations of dioxin in the soil on grounds of industrial plants and in the ashes of waste incinerators.

(h) **Ukraine.** Thyroid cancer in 3 contaminated areas of Ukraine following the Chernobyl accident.

The information collected and evaluated from ten CEE countries provides the following overall picture:

Poland—The predominant environmental health threat in Poland is the regional hot spot in the Katowice-Kraków area. Threats to human health are mostly due to airborne exposures, and secondarily to deposition of metals (especially lead) in soil. Widespread water pollution has not been shown to be a significant risk to health at this time, presumably because there is a tradition of not using tap water for drinking.

Czech Republic—Air pollution in the mining districts of Northern Bohemia forms a regional hot spot, which is the primary source of environmental health problems. There are smaller areas of concern in industrial areas of Central Bohemia and Moravia, as well as in Prague. As in Poland, water pollution is not a major current concern with respect to human disease.

Slovak Republic—The pattern in the Slovak Republic is different from Poland and the Czech Republic, in that nitrates in drinking water in rural areas appear to be a significant problem. In addition, there are human health problems associated with air pollution from specific plants in a handful of specific locations.

Hungary—In Hungary, areas with human health problems in relation to the environment tend to be old industrial areas with a confluence of airborne pollution sources, such as Borsod County and the industrial areas of Budapest, or areas with a single major point source, such as Ajka. Waterborne exposures to nitrates are important as well in Borsod County, and there are problems with naturally-occurring arsenic in water in Békés County.

Bulgaria—The pattern in Bulgaria is similar to Hungary with a mixture of single and multiple point sources of air pollution predominating. However, the number of areas with documented associations between air pollution and human health outcomes is much larger in Bulgaria than in Hungary. Nitrate pollution of water is a widespread problem, affecting drinking water supplies in rural areas throughout the Western part of the country.

Romania—Most of the air pollution related problems in Romania are due to intense exposures from single point sources. These tend to be clustered in certain parts of the country, especially in the area of Transylvania near Cluj. Nitrate pollution is common in 38 of 41 districts of the country.

Baltic Countries—Aside from prodigious dust emissions from a cement plant in Kunda, Estonia, and a small

number of other local concerns, air pollution problems in the Baltic Countries tend to have less health significance than in other parts of Central and Eastern Europe. Instead, problems with water pollution have come to the fore. Rural Lithuania has problems with nitrates which are of human health significance. Riga has had an epidemic of waterborne hepatitis A as a result of a temporary lack of coagulant to treat drinking water from the Daugava River. All three countries have had to close beaches in recent years to prevent the spread of infectious diseases due to inadequate sewage treatment in adjacent settlements.

Russia—It is not clear whether or not the principal environmental health problems in Russia are the same as those in the rest of Central and Eastern Europe. Russia's size and tremendous diversity impose significant obstacles to generalization. The task is made more difficult by the fact that relevant information has, according to one estimate, been generated by more than 100 different institutes around the country.

A preliminary assessment suggests that industrial facilities are the most important sources air pollution causing respiratory and developmental problems in urban and industrial locations in European Russia. Chief among these are chemical plants, which emit organic vapors and irritant gases, and petroleum refineries, which emit polycyclic aromatic hydrocarbons. As in other parts of Eastern and Central Europe, emissions of lead from lead smelters, lead-cadmium battery plants, and storage battery factories have been linked with high blood levels in children living in the vicinity of the plants. Suspended particulate matter is a concern in many urban areas. Finally, there is concern about exposures to ionizing radiation in communities adjacent to military-industrial facilities.

As in other countries in the region, it appears that elevated nitrate levels in drinking water may be a widespread problem. Arsenic, pesticides, and petroleum products may also be contaminating drinking water in some places.

Table A1.1 Major industrial plants located in selected pollution "hot-spots"

			Nature of environmental problems			Number of plants						
Country	*Location*	*Population ('000)*	*Epidemiological links*	*High levels of dust, SO_2 or both*	*High levels of lead*	*Power and district heating*	*Iron and steel*	*Non-ferrous metals*	*Refining and petrochem.*	*Organic chemicals*	*Inorganic chemicals*	*Pulp and Paper*
Bulgaria	Dimitrovgrad	56.2	A, P	•		2					1	
	Devnya	30.0	A, C	•		1				1	1	
	Kurdzhali	58.0	Pb	•				1				
	Sofiya	1,221.4	A	•		1		1				1
	Ruse	210.2	A, C	•					1			
	Plovdiv	374.0	Pb, C	•				1				
	Stara Zagora	186.7		•							1	
	Pernik	97.2	Pb, C	•		1	2					
	Vratsa	80.5	A, C	•							1	
	Kremikovtsi		Pb, A, C			1	1					
	Varna		A			1						
	Burgas		A			1	1		1	1		
	Razlog		C									1
	Other					2	-	3	1	-	1	4
Czech Republic	Northern Bohemia:											
	Usti nad Labem	106.4	A, C	•						1		
	Litvinov	29.9		•					1	1	1	
	Most	70.8	A, C	•					1			
	Central Bohemia:											

(Table continues on the following page)

Table A4.1 (continued)

			Nature of environmental problems			Number of plants						
Country	*Location*	*Population ('000)*	*Epidemiological links*	*High levels of dust, SO_2 or both*	*High levels of lead*	*Power and district heating*	*Iron and steel*	*Non-ferrous metals*	*Refining and petrochem.*	*Organic chemicals*	*Inorganic chemicals*	*Pulp and Paper*
	Prague	1,215.6		•					1			
	Kladno	73.3		•			1					
	Melnik	19.7		•	•	3						
	Pribram		Pb					1				
	Neratovice		A							1	1	
	Kralupy		A						1	1		
	Southern Bohemia:											
	Sokolov	28.5		•							1	
	Plzen	174.7		•		1	1	1				
	Ostrava	331.5				1	2		2		1	
	Brno	392.2				1						
	Other					31	2	4	3	-	4	6
Slovakia	Bratislava	442.9	A	•		3			1	1	1	
	Ziar nad Hronom	21.4		•				1				
	Other					8	1	2	2	2	3	6
Hungary	Borsod-Abauj-Zemplen industrial zone:											
	Karincbarcika		C							1	1	
	Ozd			•			1					
	Budapest		C, P	•	•		1				1	1

			Nature of environmental problems			Number of plants						
Country	*Location*	*Population ('000)*	*Epidemiological links*	*High levels of dust, SO_2 or both*	*High levels of lead*	*Power and district heating*	*Iron and steel*	*Non-ferrous metals*	*Refining and petrochem.*	*Organic chemicals*	*Inorganic chemicals*	*Pulp and Paper*
	Northern Transdanubian region:											
	Dorog	13.0	Pb	•		1						
	Komarom	19.6		•					1			
	Tatabanya	73.8		•		1		1				
	Central Transdanubian region:											
	Ajka		Pb	•		1		1				
	Baranya County:											
	Pecs			•		1						
	Szolnok			•	•						1	
	Other					24	2	2	4	2	3	1
Poland	Katowickie:											
	Dgbrowg Górnicza	139.2	M	•	•		2					
	Chorzów	131.5	M	•	•	1	2					
	Świętochowice	60.6	M	•	•		1					
	Katowice	366.9	M, P	•	•	1	1					1
	Tarnowskie Góry	74.4	M	•	•				1			
	Zawiercie	57.1		•			1					
	Rybnik	144.8		•		1						

(Table continues on the following page)

Table A4.1 (continued)

			Nature of environmental problems			Number of plants						
Country	*Location*	*Population ('000)*	*Epidemiological links*	*High levels of dust, SO_2 or both*	*High levels of lead*	*Power and district heating*	*Iron and steel*	*Non-ferrous metals*	*Refining and petrochem.*	*Organic chemicals*	*Inorganic chemicals*	*Pulp and Paper*
	Bytom	323.2	Pb	•	•		2					
	Szopienice		Pb					1				
	Krakowskie:											
	Kraków	751.3	A, C, M, P	•		1	1				1	
	Legnickie:											
	Legnica	106.1	Pb					1				
	Glogow	73.9	Pb					2				
	Toruńskie:											
	Torun	202.0		•		1					1	
	Wrocławskie:											
	Wrocław	643.6		•		1					1	
	Other					64	6	5	10	5	13	17
Romania	Bucharest	2,325.0		•	•	4						
	Piatra Neamt	117.3		•							1	2
	Zlatna	9.3		•	•			2				
	Brobeta Turnu Severin	108.0		•		1						
	Galati	305.0		•		1	1					
	Craiova	297.5		•		2					1	
	Tirgu Mures	166.0		•							1	
	Slatina	74.0	A, P	•	•			1				

			Nature of environmental problems			Number of plants						
Country	*Location*	*Population ('000)*	*Epidemiological links*	*High levels of dust, SO_2 or both*	*High levels of lead*	*Power and district heating*	*Iron and steel*	*Non-ferrous metals*	*Refining and petrochem.*	*Organic chemicals*	*Inorganic chemicals*	*Pulp and Paper*
	Hunedoara		A	•			1					
	Copsa Mica		Pb, P					1				
	Baia Mare		Pb, A					2				
	Suceava		A			1						1
	Mintia		A			1						
	Otelul Rosu		A				1					
	Navodari		A			1			1		1	
	Remicu-Vilcea		A							1	1	
	Turda		C, P							1	1	
	Other					20	5	3	12	7	10	11
Estonia	Narva	82.3	A, C, P	•		2						
	Tallinn	484.4		•		2						1
	Kohtla-Jarve		A, C, P			2					1	
	Kehra		P									1
	Other					5					-	-
Latvia	Ventspils	50.4		•							1	
	Liepaja			•			2					
	Riga			•		7					1	
	Other					-	-				-	1
Lithuania	Kaunas		A,C	•		2						

(Table continues on the following page)

Table A4.1 (continued)

			Nature of environmental problems			Number of plants						
Country	*Location*	*Population ('000)*	*Epidemiological links*	*High levels of dust, SO_2 or both*	*High levels of lead*	*Power and district heating*	*Iron and steel*	*Non-ferrous metals*	*Refining and petrochem.*	*Organic chemicals*	*Inorganic chemicals*	*Pulp and Paper*
	Siauliai			•		1						
	Kedainai			•		1					1	
	Vilnius			•		3						
	Klaipeda			•		1						1
	Jonava		A, C	•		1					1	
	Other					11			1		-	1
Belarus	Polotsk			•					1			
	Magilev			•		1						
	Grodno			•		1					1	
	Gomel			•		1					1	
	Minsk			•		2						
	Novopolotsk			•		1				1		
	Other			•		4	1		1	-	1	1
Western Russia	Lipetsk			•			2		1			
	Novgorod		Pb, M	•							1	
	Smolensk			•							1	
	Kashira (Moscow oblast)			•		1						
	Nizhnckamsk (Tatariya)			•					1	1		
	Segezha (Karelea)			•								1
	Krasnodar			•					1		1	

			Nature of environmental problems			Number of plants						
Country	*Location*	*Population ('000)*	*Epidemiological links*	*High levels of dust, SO_2 or both*	*High levels of lead*	*Power and district heating*	*Iron and steel*	*Non-ferrous metals*	*Refining and petrochem.*	*Organic chemicals*	*Inorganic chemicals*	*Pulp and Paper*
	Balakovo (Saratov oblast)			•							1	
	Gubakha (Perm oblast)			•					1			
	Dzerzhinsk (Nizhegorod oblast)		M	•						1	1	
	Saratov			•		1			1			
	Astrakhan Stepnoy		Pb	•								1
	Novokuybyshevak (Samara oblast)			•						1		
	Kirovo-Chepetsk (Kirov oblast)			•					1			
	Novocherkassk (Rostov oblast)			•		1						
	Syzran (Samara oblast)			•					1			
	Tolyatti (Samara oblast)			•							1	
	Saint-Petersburg		Pb, A, M			1		2			1	
	Berezniki		Pb, A, M								1	
	Yaroslavl		Pb								1	
	Samara		Pb						1			
	Nizhnyy		Pb, M						1			
	Voskresensk		A								1	
	Ufa		C						3			
	Other					20	9	10	20	15	7	23

(Table continues on the following page)

Table A4.1 (continued)

			Nature of environmental problems			Number of plants						
Country	*Location*	*Population ('000)*	*Epidemiological links*	*High levels of dust, SO_2 or both*	*High levels of lead*	*Power and district heating*	*Iron and steel*	*Non-ferrous metals*	*Refining and petrochem.*	*Organic chemicals*	*Inorganic chemicals*	*Pulp and Paper*
Ukraine	Donetsk	1,110.0		•		2	1		1	1		
	Kryvyi Rih	713.0		•		1	1		1			
	Odessa	1,115.0		•					1		1	
	Zaporizhzhia	884.0	A,P	•		1	2	1	1			
	Dneprodzerzhinsk	300.0		•			1		1	1	1	
	Dnepropertrovsk	1,179.0		•		1	2		1			
	Mariiupil	517.0	P	•			2					
	Makeeva			•			1		1			
	Kiev	2,602.0		•				1				
	Kostiantynivka		Pb				1	1				
	Other					7	4	2	16	5	8	5

Key:
A = places where there are documented associations between acute respiratory diseases and air pollution.
C = places where there are documented associations between chronic respiratory diseases and air pollution.
M = places where there is reasonably strong evidence of a connection between mortality and air pollution.
P = places where there are documented associations between abnormal physiological development and air pollution.
Pb = places where there is a problem with over exposure to lead among children.

Annex Two

Occupational Health[1]

There is a high degree of overlap between the locations of environmental health concern and the areas of industrial concentration in Central and Eastern Europe. This is not surprising since three of the principal environmental health threats are dust, toxic gases, and lead: all of which are emitted in large degree from industrial sources. To the extent that these polluting industries affect both the health of the communities in which they are located and, also, the workers who work there, a remediation strategy which targets environmental health problems will also be effective in capturing workplaces with significant occupational health problems. The best example of this is lead smelters, where significant community exposures to children and in-plant exposures to workers seem to coexist everywhere they have been measured in tandem in Central and Eastern Europe. However, there are some important exceptions to this general pattern which need to be carefully considered in the development of an environmental action program. These include two types of locations: those where environmental health problems exist in the absence of occupational health problems and, conversely, those where occupational health problems exist in the absence of environmental health problems.

In many locations in Central and Eastern Europe stack emissions from industrial sources are prodigious but in-plant exposures are trivial, or, at least, no worse than would be expected in comparable facilities in the West. This would appear to be true for many coal-fired power and heating stations as well as certain cement plants, such as the one in Kunda, Estonia. But the phenomenon is not confined to these sorts of facilities. In general, the environment inside industrial facilities, except in Romania, seems to be relatively closer to Western norms than conditions in the adjacent communities, despite a widespread lack of basic safety equipment and exceedingly lax enforcement of health and safety regulations. A good example of this is the Huta Sendzimira steel works near Kraków. The facility has historically been a principal source of air pollution for Krakow and was represented to us as a dangerous place to work, since only 13 percent of the workers were said to retire without a disability. However, our visit to the facility revealed that this statistic distorted the realities of working conditions in the plant, which were no more threatening than an average North American steel plant. It turned out that the high rate of disability could best be explained as a response to the exceedingly generous disability pension benefits that existed for workers in heavy industry in Poland, rather than the workers' experience of disability *per se*.

Routinely reported data on worker absenteeism and occupational disease across Central and Eastern Europe reveal a pattern which supports these perceptions. Absenteeism rates tend to be high (probably reflecting benefit-driven behavior), while occupational disease rates tend to be no higher than in Western countries. This latter statement, however, must be taken with three important qualifications. First, certain occupational diseases are underdiagnosed and under-recognized in Central and Eastern Europe. Most important among this group are occupational cancers, which have received no recognition at all as occupational diseases and very little investigation has been done of them. Second is the problem of political interference in the reporting of occupational disease. In Czechoslovakia, a political decision was made in the early 1980s to suppress data on silicosis cases at the national level. In Romania, financial incentives were exerted on plant physicians to keep the number of reported cases of occupational disease below a targeted value on an annual basis. Anecdotes about less systematic forms of misreporting came out in other countries. Finally, the prevalence of the "traditional" occupational chest diseases, silicosis and silicotuberculosis, certainly is higher among Central and Eastern European workers in exposed occupations than among their counterparts in the West.

This third qualification of the occupational disease statistics points directly to the nature of many of those places where there are severe occupational health problems in the absence of environmental health problems.

1. Country-specific details are in the underlying technical report on *Environment and Health in Central and Eastern Europe.*

These tend to be places with heavy workplace dust exposures in the absence of large scale emissions into the community, in other words, in mines. This generalization would seem to apply to many underground coal and uranium mines in Central and Eastern Europe. A good example is found in Pecs, Hungary, where a uranium mine and a coal mine were both in production until recently. There is currently a mini-epidemic of lung cancer which began among the miners from the (now defunct) uranium mine, while, at the same time, the coal mine (still operating) has been producing 100-120 new silicosis cases per year among a workforce of 4100. Nonetheless, community air quality is not of particular public health concern. Similarly, epidemiologic data for uranium miners in Czechoslovakia suggest an ongoing lung cancer risk there. To be sure, there are examples of especially dangerous workplaces, other than mines, in Central and Eastern Europe which do not coexist with significant community exposures. But, when countries other than Romania are considered, it is fair to say that a large proportion of the dangerous workplaces that do not lead to community exposures are in the energy sector, and should become targets of closure or reinvestment as part of a program of reform in that economic sector.

Annex Three

Modelling the Impact of Economic Reform and Industrial Restructuring

The scenario analysis described in chapter III is based on an examination of the following five scenarios:

(i) The "main scenario" is regarded as the most plausible outcome over the next 20 years on the basic premise that a reasonably comprehensive reform program will be pursued over the next 5 years. The environmental performance of new capital equipment is assumed to be equivalent to the environmental standards operative in Western Europe and the United States during the early 1980s. This means that the emissions from new plants will be similar to the average level of emissions from West European or U.S. plants operating today.

(ii) The "slow/delayed reform scenario" assumes that pricing and other market reforms are delayed until 1995/96 and that the reform process proceeds rather slowly so that incentives to reduce energy consumption and to invest in new, more efficient, capital are much weaker and operate over a longer time period. This scenario implies that any economic recovery after 1995 will be much weaker and that growth in the decade 2000–2010 will also be lower. Environmental standards are as for the main scenario.

(iii) The "accelerated reform scenario" assumes governments press ahead with radical economic reforms and strict enforcement of hard budget constraints for enterprises. These pressures, combined with an active policy to encourage foreign investment, will shorten the period of adjustment to new incentives and higher prices. The immediate decline in employment and output will be greater because more of the old capital stock is scrapped but the subsequent recovery will be more rapid with faster economic growth through the decade 2000–2010. Environmental standards are as for the main scenario.

(iv) The "EC standards for new plants scenario"—referred to as ECS NP—is based on the same economic assumptions as the main scenario but assumes that all new capital equipment is required to meet emission standards equivalent to those applied in the European Community in the early 1990s (rather than the early 1980s).

(v) The "EC standards for all plants scenario"—referred to as ECS AP—adds to the previous scenario the assumption that all plants are gradually required to conform to current EC emission standards by 2010 by the installation of end-of-pipe controls or by appropriate changes in process technology.

Comparison of the first three scenarios illustrates the impact of differences in the nature and speed of economic reform on the countries' environmental problems, while comparison of the scenarios specified in (i), (iv) and (v) illustrates the contribution of alternative environmental policies.

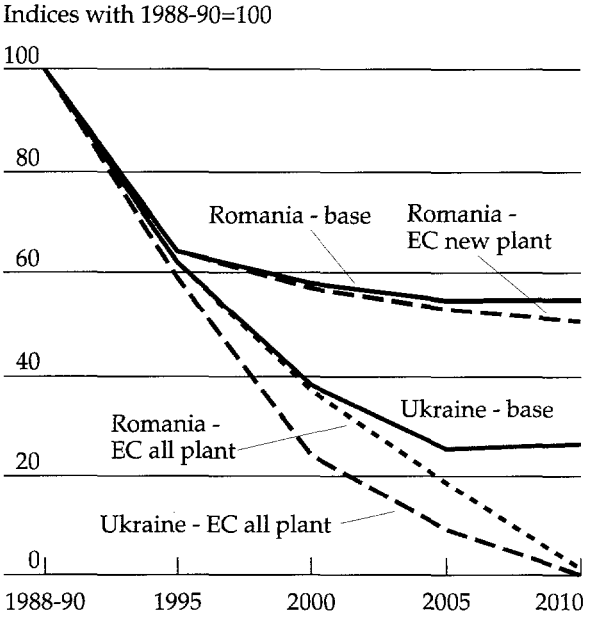
Figures A3.1–A3.7 show the projected paths for emissions of various pollutants in different countries in the region. In each case the two solid lines define the band into which the countries fall. The top line represents the outcome for a country with high emissions over the period and the lower solid line a country with low emissions. The figures show that in almost all cases emissions continue to fall until after 2000 as a result of the combined impact of higher energy prices, industrial restructuring and new investment. Emissions of NO_x are one exception to this pattern because growth in the number and use of vehicles can easily outstrip the decline in emissions from stationary sources.

Slower economic reform leads to a slower decline in emissions but over a longer time span. Still, delays in economic reform imply that emissions will be higher throughout the whole of the two decades studied. Accelerating economic reform also accelerates the rate of decline of emissions, and their recovery as economic growth bounces back.

Figure A3.1 Emissions of particulates in Hungary and Russia under alternative reform scenarios

World Bank estimates

Figure A3.2 Emissions of particulates in Romania and Ukraine under alternative environmental standards



World Bank estimates

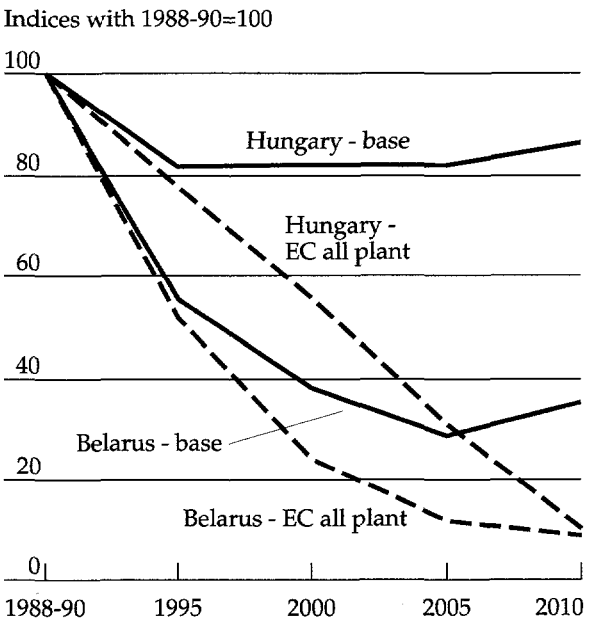
Particulate emissions under alternative reform scenarios. Hungary had higher energy prices and a lower level of energy-intensity in 1988 than other countries in Central and Eastern Europe. Economic reform has therefore reduced energy-related air pollution much less than elsewhere. In Russia, however, the gains will be large with a fall of 77% in total particulate emissions for the main reform scenario. Slower reform means that the decline will be less, though still significant. Faster reform implies a greater initial fall in emissions, offset by faster economic growth after 2000. Bulgaria, Poland, Ukraine and other FSU republics should follow paths similar to that for Russia, whereas Romania and the Czech and Slovak Republics lie between Hungary and Russia.

Map 1 (at the end of this report) presents the regional concentration levels for total dust in 1990. In the south-western part of Poland, northern Bohemia, in Eastern Germany near Leipzig and in the Ukrainian Donetsk area, concentration levels exceed WHO-guideline values for yearly averages (60-90 µg/m3).

Particulate emissions under alternative environmental standards. Romania can expect only a modest reduction in particulate emissions from economic reform alone because it already relies heavily on gas for power generation. The imposition of stricter standards only on new capital equipment implies a relatively small improvement in emissions; applying the same standards to all sources progressively would reduce emissions in 2010 to a tiny fraction of their 1989 level. Though reform makes a much bigger contribution in Ukraine, it too would benefit from the gradual implementation of stricter standards for all sources with particulate emissions less than 10% of their 1990 level by 2005. With a few exceptions, imposing stricter standards on new capital equipment alone does not lead to a significant reduction in pollution, unless performance standards for the new sources are very strict indeed. It is the *reduction of emissions from old plants which is critical to achieving substantial improvements* beyond those provided by economic reform.

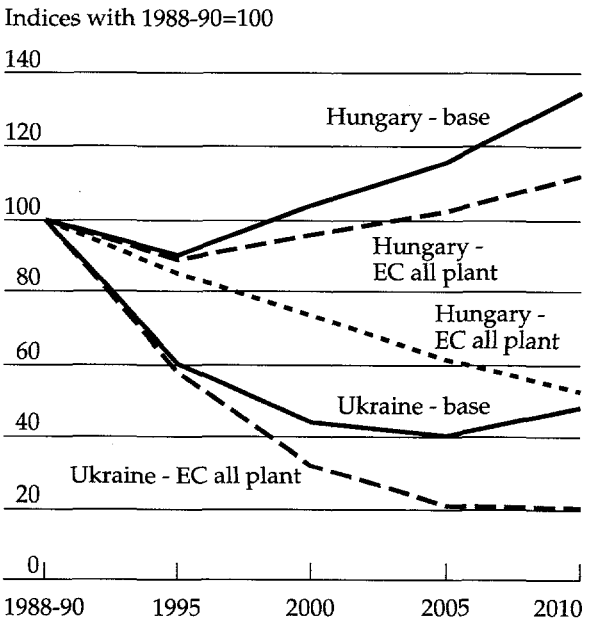
Economic reform and new investment can lead to substantial changes in the composition of emissions by source type. **Figure A3.8** below illustrates how the source composition of particulate emissions in Poland will change under alternative scenarios.

Figure A3.3 Emissions of Sulfur Dioxode in Hungary and Belarus



World Bank estimates

Figure A3.4 Emissions of NOx in Hungary and Ukraine



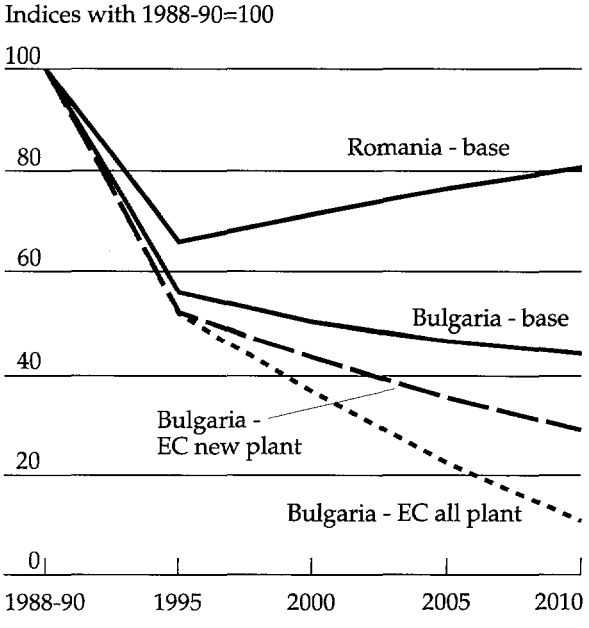
World Bank estimates

Sulfur Dioxide Emissions. The pattern for SO_2 emissions is similar to that for particulates, though in Hungary the decline due to economic reform is less for SO_2 than it was for particulates. In part this reflects a reported decline of 25% in SO_2 emissions from 1980 to 1989. A similar decline is reported for the European part of the former Soviet Union, but the published data cannot be reconciled with more recent data on trends in energy consumption in the former Soviet republics during the 1980s. Total emissions of SO_2 fall to 28% of their 1990 level by 2005 in Belarus before rising again as a result of economic growth. Applying stricter controls progressively to all plants would reduce Hungarian emissions to 30% of their 1989 level by 2005 and to less than 10% of their initial level in all countries except Poland. Economic reform alone should reduce emissions to less than 40% of their initial level in Bulgaria and Ukraine as well as Belarus, with Russia and other FSU republics falling in the range of 40-50%. **Figure A3.9** below illustrates how the source composition of SO_2 emissions in the Czech and Slovak Republics will change under alternative scenarios.

Map 3 shows those regions where concentration levels of SO_2 exceed WHO-guideline values (yearly average of 40-60 $\mu g/m^3$). In the south-western part of Poland, northern Bohemia, in eastern Germany near Leipzig, in the Ukrainian Donetsk area and in the area near Moscow, concentration levels exceed WHO-guideline values for yearly averages. **Map 4** shows that in 2010 no large-scale areas are expected to exceed annual average WHO guideline values for SO_2, assuming that all *new* investments utilize current Western technology ("Scenario 1"). Note, however, that due to local conditions within grid cells (especially in urban areas), extreme values may be higher at a sub-grid scale. Daily average values are still expected to be exceeded in a number of areas.

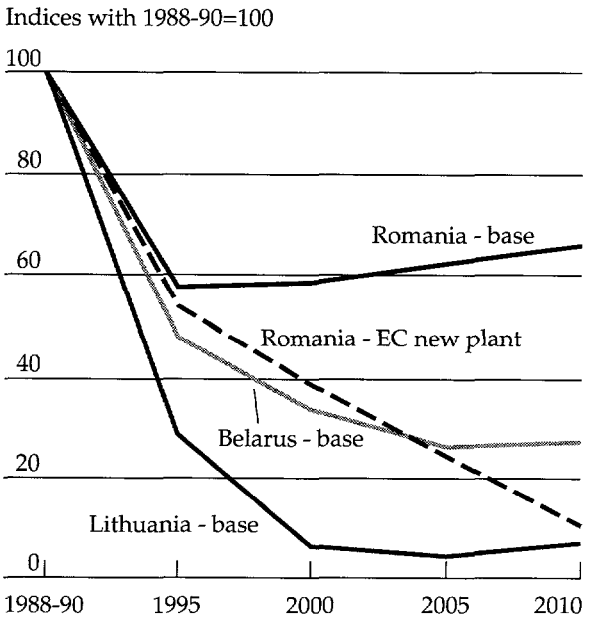
Nitrogen Oxide Emissions. Emissions of nitrogen oxides in Hungary are the clearest case of economic growth outstripping any gain that higher energy prices might induce in energy efficiency. While coal is the main source of particulates and sulfur dioxide, the use of petroleum products is responsible for a substantial fraction of NO_x emissions. In 1989, Hungarian coal prices were less than one-half of comparable West European prices, while prices for petroleum products were above U.S. prices and only about 30% below West European prices. All the other countries outside the former Soviet Union had prices for petroleum products which were relatively less distorted than coal prices. As a consequence, total emissions of NO_x from the Central and South-Eastern countries only falls to 66% of the initial total by 1995 and rises thereafter to 97% by 2010. On the other hand, prices for petroleum products in the Soviet Union were only one-fifth of West European prices on average, whereas coal prices were about one-half of West European prices. Thus, the decline in NO_x emissions is much more dramatic in all of the FSU countries, with Ukraine's emissions falling to 44% of the 1990 level in 2005 before rising slowly thereafter. Strict emission standards applied to all existing plants and equipment would be required to bring Hungary's emissions down to the same ratio by 2010. However, the *application of stricter emission standards to new equipment alone has a significant impact in this case,* leading to an average growth in NO_x emissions which is much lower than the general rate of economic growth.

Figure A3.5 Emissions of Lead in Bulgaria and Romania



World Bank estimates

Figure A3.6 Emissions of Cadmium in Belarus, Lithuania and Romania



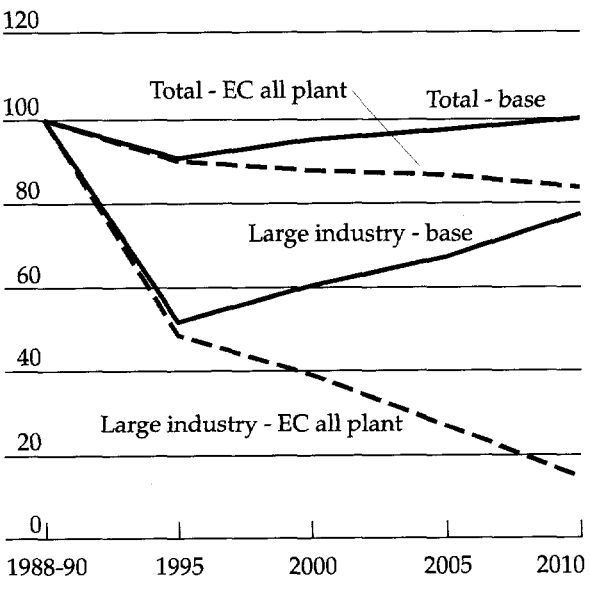
World Bank estimates

Lead emissions. Economic reform should lead to a substantial reduction in emissions of lead particles in Bulgaria, but the improvement is both less and more transitory in Romania. The differences reflect the relative contributions of the non-ferrous metals sector, combustion of fuels in other large plants, and leaded gasoline. Where non-ferrous metal plants make a substantial contribution to total emissions, as in Bulgaria, total emissions can be sharply reduced even without a large shift to the use of unleaded gasoline. This is because the initial decline in production is followed by a reduction in emissions of lead per unit of output associated with new equipment and stricter controls. In Romania, however, stricter standards on the lead content of gasoline are crucial if total lead emissions are to be reduced substantially. The projection for EU standards applied to new plant alone assumes that the average lead content of gasoline is reduced to 0.15 grams per liter. This would lower the 2010 index of total emissions to 55 (from 80). The projection for EU standards applied to all plant assumes that one-half the vehicle stock will rely upon unleaded gasoline by 2010, which yields an emissions index of 17 at the end of period. **Figure A3.10** below illustrates how the composition of lead emissions by source type in Bulgaria will change under alternative scenarios.

Cadmium and other heavy metal emissions. Emissions of heavy metals (other than lead), for which cadmium is used as a general indicator, depend upon output in the metallurgy industry and on the use of coal and oil. Lower output from the metallurgy sector, greater energy efficiency and better environmental performance as old plant is scrapped all lead to large falls in cadmium emissions in Belarus and Lithuania. The main scenario for Romania indicates a sharp initial fall in emissions followed by a gradual rise. This upward trend can, however, be reversed by the gradual introduction of stricter environmental standards for all plants, so that total emissions in 2010 would be only 10% of their initial value.

Map 2 shows hot spot areas of cadmium emissions in Poland (Katowice), the Czech and Slovak Republics, Hungary, Romania, Bulgaria, Croatia, Ukraine (Dnipropetrovsk) and Russia (Caucasus, Murmansk).

Figure A3.7 Emissions of BOD in Russia



World Bank estimates

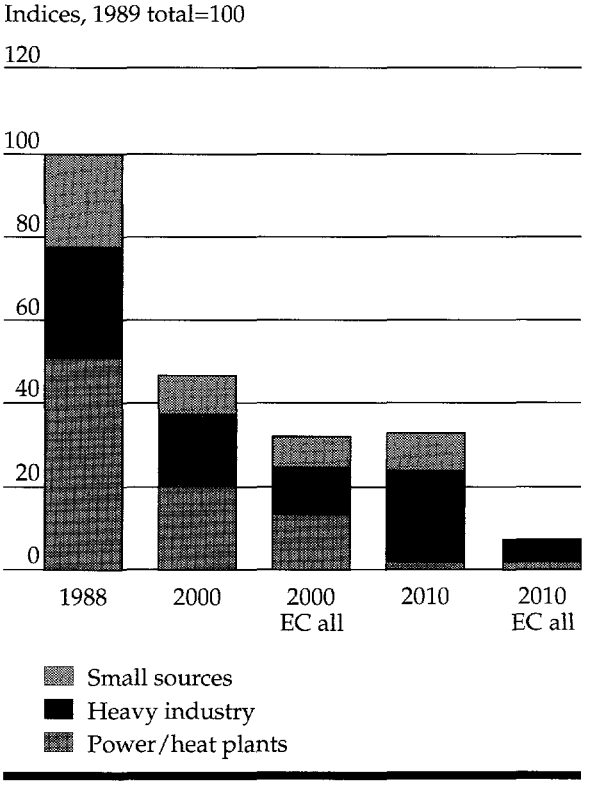
Water Pollution. Large industrial plants account for less than 15% of total emissions of BOD in Russia. The remainder comes from households and small industrial plants which are likely to discharge their effluent to municipal sewers. Thus, a substantial drop in large industrial emissions up to 1995, even if reinforced by stricter environmental standards for all plants, has a relatively small impact on *total* emissions. Even if governments encourage or require small industries to discharge their wastewater to central pre-treatment or treatment plants, the relative contribution of municipal discharges to water pollution will grow over time. In view of the limited resources available for treating these discharges, any significant improvement in water quality on a broad basis must depend upon investment in facilities and technologies which optimize ambient water quality in a manner which accommodates the constraints on investment.

The key assumptions characterizing the different scenarios are as follows:

- The paths for GDP follow current World Bank estimates up to 1995. For most countries, GDP levels out between 1993 and 1995 at 65-75 percent of its pre-transition level. In the main scenario GDP is assumed to increase at 6.5 percent per person per year over 1995-2000 and at 4 percent per person per year over 2000-2010. These growth rates are high but historical experience suggests that they can be achieved if the necessary reforms are implemented. The accelerated growth scenario follows an East Asian pattern, whereas the slow/delayed reform is based on growth rates post 1995 that are similar to those achieved by the former Soviet Union.
- The share of investment in GDP falls sharply to 1995 and recovers thereafter but only to 20 percent in 2000 and 25 percent in 2010–well below past levels. Slower or faster growth implies correspondingly lower or higher investment shares.
- The composition of private and public consumption gradually shifts by 2010 towards the pattern typical of middle income countries with similar incomes measured in terms of purchasing power parity.
- Improvements in x-efficiency and the adjustment of energy and other inputs per unit of output using old capital are phased over a period of 10 years in the main scenario. This adjustment period is 20 years for the slow/delayed reform scenario and 5 years for the accelerated reform scenario. Under the latter it is assumed that 20 percent of the initial capital stock is scrapped by 1995 as enterprises contract or close down. Under the slow/delayed reform scenario it is assumed that new investment has input-output coefficients based on typical former Soviet technology rather than Western technology.
- The long run aggregate elasticity of energy use in industry is approximately -0.5 for the main and accelerated reform scenarios. This is typical of the long run responses of West European economies to the two oil shocks. Under the slow/delayed reform scenario it is only -0.075 which is more typical of the response of centrally planned economies to price changes in the past. Note that the short run price elasticities are much lower because the adjustment to higher prices is phased over 5, 10 or 20 years as appropriate.
- Lags have been built into the adjustment process to reflect the slow initial response of industrial energy consumption to changes in output, so that energy-related pollution declines more slowly than might be expected from a simple link between industrial output and energy demand.
- The detailed assumptions about the manner in which the stricter environmental standards in the ECS NP and ECS AP scenarios will affect various emission coefficients are described in a Background Paper to the Action Programme. In particular, the coefficients relating to emissions of NOx and lead from household use of oil products, which is assumed to be almost entirely comprised of gasoline in automobiles, do not imply that all new automobiles will be fitted with catalytic converters. For the ECS AP scenario it has been assumed that 50% of the vehicle fleet will run on unleaded gasoline.

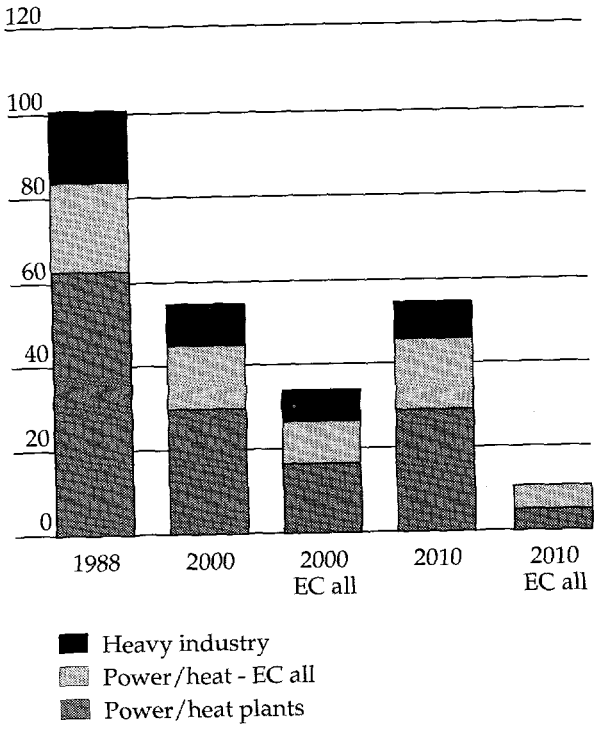
Because the model is based upon detailed projections at an industry level, it is possible to distinguish between those industries—referred to as heavy industry—which are typically characterized by large individual sources and other production whose emissions derive from many small sources. The distinction is important because it is much easier to monitor and enforce emission standards for a limited number of large sources in the paper, chemical, cement, metallurgy and heavy engineering industries than for the much greater number of medium and small enterprises in other branches of the industrial sector as well as agriculture, services and households. The relative contributions of different types of sources to total emissions of some key pollutants are shown in the following figures.

Figure A3.8 Particulate Emissions in Poland, by Type of Source



For particulates, investment in new power and heat plants or in rehabilitating existing ones will greatly reduce the contribution of these sources to total emissions in countries like Poland. Remember, also, that this reduction in the share due to power and heat plants accompanies a large fall in total emissions. The reduction in emissions from large industrial sources is less than for total emissions, unless stricter standards are applied to existing as well as new plants. If strict standards are applied to all plants, then it is small sources—households, services and small industry—which make the largest contribution to total emissions. Still the overall level of emissions is so much lower that this would hardly warrant stricter environmental controls on small sources over the time period considered.

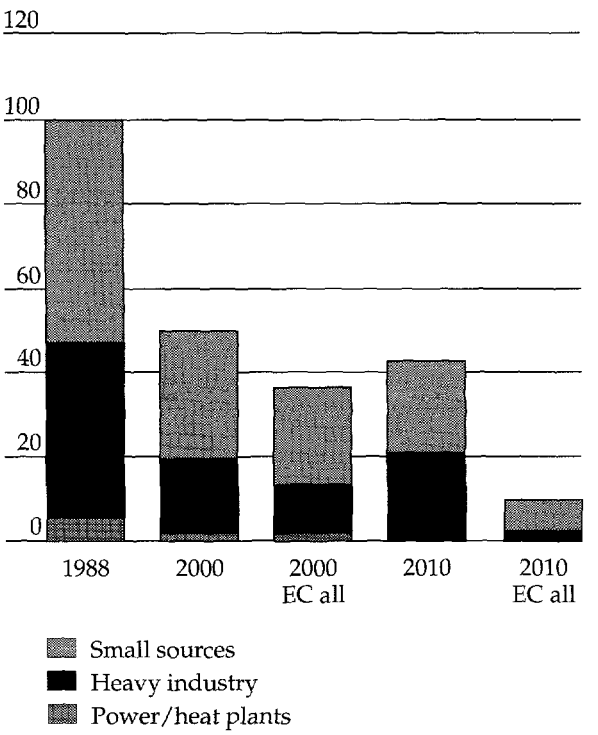
Figure A3.9 SO2 Emissions in the Czech and Slovak Republics by Type of Source



(Data were not available on the separate republics)

For sulfur dioxide, as for particulates, large reductions in total emissions are not uniformly spread across different types of source. The share of power and heat plants tends to fall, especially when stricter standards are applied to all such plants. The share of heavy industry tends to rise in the absence of stricter standards, whereas with stricter standards it is the share of small sources that tends to rise. However, small sources never become the largest contributor to total emissions of sulfur dioxide, so that environmental policies and controls should focus on the power and heat sector and on large industrial plants.

Figure A3.10 Lead Emissions in Bulgaria, by Type of Source



In Bulgaria, as in all countries, vehicles are the major source of lead emissions. Emissions from heavy industrial plants originate both from non-ferrous metal smelters, some of which can be cleaned up at a reasonable cost, and from the combustion of coal and oil. The latter can only be reduced by installing controls to reduce all dust and particulate emissions. Thus, changes in the contribution of large industrial sources to total lead emissions after the initial economic downturn depend upon the relative strictness of controls on vehicle emissions and dust emissions from large plants. For vehicles, improvements in average fuel efficiency combined with an upgrading of gasoline quality will bring about a gradual decline in the share of lead emissions from small sources under the main scenario and the scenario with EC controls applied only to new equipment. On the other hand, strict controls applied to all large industrial plants mean that an increasing share of (the much lower) lead emissions will come from small sources. This implies that reducing lead emissions even further will depend upon an almost complete shift to the use of lead-free gasoline.

Slower economic reform leads to a slower decline in emissions but over a longer time span. Still, delays in economic reform imply that emissions will be higher throughout the whole of the two decade studied. Accelerating economic reform also accelerates the rate of decline of emissions, but this means that the trough is reached more rapidly and continuing rapid economic growth can lead to the total level of emissions overtaking those under a scenario in which both reform and economic growth are less rapid.

Annex Four

Why Raise Energy Prices?

Until 1990, energy prices were set well below market levels in all Central and Eastern European countries. Raising energy prices is the classic win-win policy which improves economic efficiency and generates large environmental benefits. This report emphasizes the environmental consequences of adjusting energy prices to world market levels. But what are the economic arguments? In summary, most sources of energy are prime examples of commodities which can be traded freely. This means that a country which sells energy at domestic prices below the world market price is sacrificing the difference between the domestic selling price and the world price.

Consider the case of crude oil in Russia. In mid-1992 this was being sold to Russian refineries at a price of Rb 2200 per ton while the equivalent export price was US$120 per ton or Rb 15000 at the *then prevailing* market exchange rate of US$1 = Rb 125. This would not matter if the level of oil demand in Russia were unaffected by the domestic price, since the price differential would simply represent an income transfer from oil producers or the government to oil consumers. However, Russia is now the most energy-intensive economy in the world with total energy consumption amounting to 6,000 kilograms of oil-equivalent per person for a GNP per person of about US$2,500. It uses about 8 times as much energy per dollar of GDP as the average for Western Europe. Even allowing for harsh weather it is clear that low prices lead to higher levels of consumption and wasteful use of energy.

Simple calculations suggest that an immediate decision to raise energy prices to the world market level should, over a period of 5-6 years, halve that level of energy-intensity. This would enable Russia to export an additional 90 million tons of crude oil per year worth more than US$10 billion (after allowing for changes in total GDP). Since Russia's revenue from exports of goods and services outside the former Soviet Union was about US$53 billion in 1991 and is expected to be little more than US$35 billion in 1992, the additional oil exports would imply a substantial increase in Russia's ability to import capital equipment or consumer goods from the rest of the world. This is a simple measure of the potential gains from increasing domestic energy prices to world market levels. There would, of course, be some capital investment (and social) costs involved in raising energy efficiency to adjust to higher energy prices, so that the net gains are somewhat more difficult to estimate. But the difficulties of adjusting to higher energy prices are usually exaggerated, and US$10 billion per year can buy a large amount of energy conservation.

Russia is an oil exporter, but the story is essentially similar for Ukraine which is a large net importer of oil. In its case the burden of low domestic energy prices (for a given level of world prices) is felt in a reduced capacity to import goods and services from the rest of the world. Similar calculations suggest that the cost of its oil imports could fall by US$2-3 billion per year over the next 5-6 years. While information on Ukraine's trade balance is lacking, this figure may be compared with the country's total foreign debt in convertible currencies which was estimated to be about US$10 billion in late 1991.

Source: Based on material in *Russian Economic Reform: Crossing the Threshold of Structural Change* (Washington, DC: The World Bank, 1992).

Annex Five

Environmental Standards

There are three kinds of environmental standards which serve quite different purposes in environmental policy:

• *Ambient standards* set maximum levels of a pollutant in the receiving medium (air, water and soil). Ambient standards offer a simple method of establishing priorities since areas (or stream lengths) which comply with the relevant ambient standards are considered to require no further intervention, while other areas may be ranked by the extent to which concentrations exceed the ambient standards. Ambient standards require an explicit agreement on the environmental quality objectives that are desired, and the costs that society is willing to accept to meet those objectives. Because ambient standards can be set at different levels for different locations, it is possible to use them to protect valuable ecosystems in a way that would not be possible by using emission controls.[1] It has been usual to establish an ambient standard for a pollutant by reference to the health effects of different levels of exposure (as discussed in Chapter II), although certain countries have been moving more recently toward ambient standards based on the capacity of natural ecosystems to absorb environmental pollution. Historically, ambient standards in the rich market economies have been continually tightened in the light of medical evidence on the impact of certain pollutants, and as the demand for better environmental quality has increased.

• *Emission standards*[2] set maximum amounts of a pollutant that may be given off by a plant or machine. They may be established in terms of what can be achieved using the "Best Available Control Technology" (BACT) or by trying to estimate the volume or concentration of a pollutant in exhaust gases or wastewater discharges that is compatible with ensuring that areas around the plant meet the ambient standards that are defined for the pollutant. Content standards, such as fuel quality standards, may influence the amount of, *e.g.*, sulfur in fuel oil or the recycled content of packaging.

• *New Source Performance Standards (NSPS)* are specific emission standards—always based on BACT—in which the emission standard is only applied to new plants. They are a special and very rigid form of grandfathering since emissions from existing plants are treated differently from emissions from new plants. If it is costly for a plant to install the controls necessary to meet NSPS, they have the effect of prolonging the economic life of existing plants by imposing a cost handicap on new plants—of course subject to the influence of other economic and technological factors.

1. An example of this differentiation is the setting of "critical loads" for acidic depositions in different areas of Europe. "Critical Loads" are a specific application of an ambient standard designed to protect vulnerable ecosystems from the damage caused by acid rain. They are a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur, according to present knowledge. Critical Loads illustrate that it may be desirable to set joint ambient standards for several pollutants which interact or reinforce each other. Another example is the joint ambient standard for particulates and sulfur dioxide that has been adopted by the EU.

2. In some CEE countries, the term "emission limits" is used, to indicate that the emission standards are only in reference to physical emissions from the plant, regardless of the technology used. In contrast, Western emission standards often imply the requirement of a type of technology.

Annex Six

Priorities for Environmental Expenditure (Details)

This Annex provides a more detailed description of some of the environmental expenditure priorities described in chapter V. It also contains an indicative listing of possible actions as endorsed by the Lucerne ministerial conference. The Annex is structured like chapter V; in addition, nine text boxes provide specific case study examples:

- *Immediate priorities for public investment*
  (a) Non-ferrous metal smelters
  (b) Iron and steel plants
  (c) Households and small-scale boilers using coal
  (d) Treatment/pre-treatment of wastewater from small industrial plants
  (e) Rural wastewater treatment
  (f) Toxic, nuclear and other hazardous wastes
- *Investments to deal with urgent problems specific to different countries*
  (g), (h) Municipal wastewater treatment plants
  (i) Biodiversity conservation
- *Low-cost measures to address longer-term environmental problems*
  (j), (k) Traffic
  (l) Natural resource management

Immediate priorities for public investment

Non-ferrous metal smelters (a).[1] Highest priority should be given to eliminating the bulk of dust emissions from lead, lead-zinc and copper smelters where there are towns or cities that are located within the dispersion zone around the plants. There is also a case for tackling fluorine emissions from aluminum smelters but the necessary measures are substantially more expensive.

The dust from lead, lead-zinc and copper smelters can include lead, arsenic, cadmium and other toxic heavy metals in substantial quantities, especially if old-fashioned reverberatory furnaces are still in use. The damage to human health caused by such emissions is generally large, especially if they affect a substantial population, with the worst sufferers being children whose development is affected by exposure to lead. Since children are the principal victims of lead pollution, the costs are incurred over a long period of time and it is important to deal with the problem as soon as possible in order to prevent harm to those born in the next few years. It is not only direct exposure to airborne dust which is the source of damage but the deposition of heavy metals on soils which may move up the food chain or leach into drinking water. Thus, even after the installation of adequate dust control equipment it will be important to maintain a *cordon sanitaire* around smelters to prevent soils which are already contaminated with high levels of heavy metals from being used to grow crops or for grazing. These areas are often best suited for growing trees.

Remarkable improvements in the damage caused by non-ferrous smelters can be achieved by improving plant management and hygiene. Even a cursory inspection may reveal very simple measures that can be taken to reduce wind-blown dust, energy losses and other fugitive emissions. A common problem is the poor handling and storage of metal ores which results in large quantities of dust being distributed around the surrounding

1. The letters in parentheses refer to the list of expenditure priorities discussed in Chapter V.

Box A6.1 Environmental improvements in the non-ferrous metals industry

Lead and lead/zinc smelters. Lead and zinc are produced in Bulgaria, the Czech Republic, Poland, Romania, Russia, and Ukraine. Production is characterized by low grade ore and outdated technology, as well as financial weakness—high indebtedness and lack of funds for investment. Some of the ores treated in the CEE countries would not be considered economic in Western Europe, both because of the low metal content and the potential pollution problems. Indeed, the future of many plants is highly uncertain. In 1991 the Bulgarian Government announced that all primary production of lead would be closed down, although this has not yet happened. It appears that the lead and zinc subsectors are the weakest of the non-ferrous metal activities in the CEE countries.

The main environmental problem concerns emissions of dust containing lead which can contaminate soils and affect children in a wide radius around a plant. In the plants studied—Plovdiv in Bulgaria and Copsa Mica in Romania—the main sources of dust emissions were: (a) dust creation in handling the metal concentrates including unloading trucks or railway wagons, mixing and crushing operations, and transferring it to the sinter plant; (b) wind-blown losses of concentrates from stockpiles; and (c) fume and dust emissions from the sinter plant, blast furnace and other refining operations. The worst problems at both plants seem to be associated with handling the concentrates and with losses from stockpiles. Drastic reductions in output since 1989 have reduced emissions from both plants more than proportionately because concentrates are handled more carefully and dust control systems are no longer operating far beyond their design capacity. In the long run, neither plant is likely to be economically viable at current levels of output, unless the size of their workforces is drastically cut, since they are operating at less than half the scale of equivalent plants in market economies.

The immediate priorities are to control dust from concentrate reception, stockpiles and handling. At Copsa Mica, a simple system of water sprays to damp down the stockpiles—at a cost of less than $100,000—would have a big effect, provided that the water drained from the stockpiles is properly treated. Completion or installation of perimeter walls (or even complete enclosure) plus other measures to prevent spillage—costing less than $2 million at each plant—would greatly reduce the dispersion of dust. These should be "win-win" investments since most or all of the costs involved should be recouped from lower losses of concentrate. Similar "good housekeeping" measures could also reduce other emissions to both air and water at a very small cost.

At Plovdiv the dust collection system within the plant has been substantially upgraded in the last two years with the installation of new hoods and baghouse filters and the upgrading of the old equipment. The plant's management expects to be able to meet the new emission standards which came into effect in January 1993. Similar measures are the second priority at Copsa Mica. A sum of $2 million should be sufficient to repair and modernize existing controls and to install additional hoods and filters.

The sulfuric acid plants at both Plovdiv and Copsa Mica are both in a bad state of repair. Most of the sulfur dioxide produced in the sintering and roasting operations and in the blast furnace is emitted to the air rather than being recovered. New acid plant could not be justified economically, but repairs and upgrading to process more of the sinter plants gases could reduce SO_2 emissions substantially. The cost would be of the order of $3–4 million for Copsa Mica and $6–8 million for Plovdiv, part of which could be defrayed by the higher sulfuric acid yield from the plants.

area. Investment in water sprays, partial (or complete) enclosure of stockpiles and conveyors, and careful attention to cleaning roadways are the clearest possible example of good housekeeping measures which pay for themselves. The costs involved are small in relation to the value of the ores that are lost.

Even at apparently well-run plants it is possible to make large improvements by better management and meticulous attention to the details of plant housekeeping. The largest lead smelter in the United States (at Herculaneum, Missouri) was able to halve the ambient level of lead just outside its plant without any new investment, by taking steps to: (i) coordinate operations, (ii) anticipate problems and act before they caused significant emissions, and (iii) ensure that emissions are constantly monitored and that all staff are involved in measures to bring them down. By making the plant's environmental performance a constant concern of both management and workers, most CEE smelters should be able to reduce the environmental damage that they cause and improve their economic prospects even without substantial investments.

Most smelters already have dust collection systems, but they are either poorly maintained or inadequate to cope with the volumes of air coming from sintering plants and furnaces. The costs of installing new baghouse dust filters or electrostatic precipitators designed to eliminate more than 99 percent of dust emissions are quite modest, so that the complete replacement of existing controls may be cheaper in the long run than any attempt to upgrade them. For a typical lead or lead-zinc smelter, the cost of an appropriate baghouse filter system would be of the order of $6 million, while an electrostatic precipitator (ESP) costing about $10 million might be required for a typical copper smelter.

Some of the aluminum smelters in Central and Eastern European emit hydrogen fluoride and other fluorides in amounts which are a serious health hazard for those living close to the plants. Aluminum smelting is highly energy-intensive, so that many (probably most) smelters will be seen to be uneconomic as energy prices are raised to world levels, even taking account of the special electricity tariffs that are usually established for the industry. On the other hand, many of the enterprises—especially those in Russia—have taken advantage of current price distortions to operate their plants at full capacity despite the decline in domestic demand by exporting the surplus to the world market. Installing adequate environmental controls is more expensive than for other non-ferrous smelters—the cost might be

Similar measures will be required at several other lead or lead-zinc smelters in the region. In particular, three lead-zinc smelters in Upper Silesia at Bukowno, Szopienice and Olkusz in Poland, at Ordzhonikidze in Russia, and at Kostiantynivka in Ukraine plus the zinc smelter at Chelyabinsk in Russia are prime candidates for such investments.

Copper smelters. The greatest environmental problem with copper smelters in the region concerns emissions of lead and arsenic which occur as contaminants in copper ores. There are three important sources of these emissions: (a) particulates in gases from the smelting and conversion operations and dusts created in preparing and handling copper concentrates; (b) liquid effluents derived from hydro-metallurgical operations which are discharged to settling ponds; and (c) large volumes of smelter slags which may lead to the leaching of heavy metals into ground or surface waters if not handled properly.

Installation of new dust controls—electrostatic precipitators, scrubbers or baghouses—would cost $5–10 million for a smelter producing 100–200,000 tonnes of copper per year. Upgrading existing facilities should be much cheaper: the costs vary from site to site but an expenditure of $2–3 million per plant would have a large impact on dust emissions from most CEE plants. Water treatment and measures to prevent leaching from solid wastes can be more expensive—for example, $10–15 million for a water treatment plant utilizing precipitation techniques and closed circuit systems to reduce water use—but, again, it is possible to make significant improvements to existing facilities for relatively modest expenditures.

The priority sites for such expenditures include: Alaverdi in Armenia; Pirdop in Bulgaria; Glogow and Legnica in Poland; Baia-Mare in Romania; Krasnouralsk, Kushtym, Mednogorsk, Pyshma and Sredneuralsk in Russia; and Krompachy in Slovakia.

Aluminum smelters. Aluminum smelting is a highly electricity-intensive operation whose economic viability in most CEE countries is very uncertain once electricity prices have been raised to reflect true long run marginal costs. This is true even in Hungary with its domestic reserves of bauxite and the low operating costs of nuclear power, because the country relies heavily upon electricity imports from Ukraine whose marginal cost should determine the price at which power is supplied to the aluminum smelter. With such doubts about their long run prospects, it is difficult to justify the large expenditures—$50–100 million—that would be required for pot-room refits to eliminate fluorine emissions at most of the aluminum smelters. For some of the Russian smelters—for example, those at Kamensk, Krasnoturinsk, and Volgograd—such investments might be appropriate because low cost coal plus the prospect of surplus generating capacity may yield marginal costs of power that are low enough to sustain continued operation.

For other aluminum smelters in the region (e.g., Zaporizhzhia in Ukraine) the highest priority must be better management and "good housekeeping" to reduce dust and leaks from pipes. A case study of the plant at Ziar nad Hronom indicated that: (a) the equipment for handling bauxite was old and there were considerable raw material losses in the form of dust emissions; (b) the solid/liquid separation stage of producing alumina from bauxite has poorly controlled and archaic technology with the result that there are substantial caustic emissions; and (c) in-plant hygiene in the alumina reduction pot-lines is very poor and leads to severe emissions of pot-gases laden with tar, fluorine and particulates. The plant's environmental strategy relies upon the replacement of existing facilities by a new smelter by late 1994, but funds to complete the necessary investment are not guaranteed. Unless completion of the new smelter and closure of the old facilities within the next 2-3 years is assured, low cost measures would be justified to reduce dust losses of bauxite and to improve plant controls and hygiene. No detailed costings are available, but an expenditure of $2-3 million at most should result in substantial reductions in emissions.

as high as $35 million for a smelter producing 100,000 tonnes of raw aluminum per year—so that any decision to invest must first take account of the viability of the plant at realistic energy prices. Closing plants (especially those in or close to urban areas) or reducing their capacity is the first step. Only after this has been carried out should new investment in environmental controls be contemplated.

Iron and steel plants (b). Every country in Central and Eastern Europe, other than Hungary, has two or more large urban areas whose air quality is grossly polluted by iron and steel plants which belch out particulates, sulfur dioxide, carbon monoxide and miscellaneous hydrocarbons. At the same time, the economic prospect of the ferrous metallurgy industry in the region is dire. Domestic demand for its output is not likely to rise above 60 percent of pre-reform levels before the end of the century while export possibilities are severely constrained. The quality of output tends to be poor so that the existing plants are competing in the most price-sensitive part of the market and, if capital costs are properly taken into account, they have little chance of competing successfully with mini-mills that rely on electric-arc furnaces. Thus, most of the industry can survive only by utilizing capital stock that is fully depreciated and that is economic because of the region's low labor costs.

Much of the iron and steel industry in Central and Eastern Europe relies upon out-dated and inefficient technology which results in poor environmental performance. Open hearth furnaces account for almost half of crude steel production. By ensuring that steel capacity with the worst environmental record is shut down, governments can achieve substantial reductions in emissions as well as enhancing average levels of productivity and energy-efficiency for their steel industries. In many cases this will mean that open hearth units will be closed at plants which combine both open hearth and basic oxygen steel-making—for example, two-thirds of total capacity at both Chelyabinsk and Magnitogorsk in Russia consists of open hearth units.

In the face of such pressures, Poland has already decided to restructure its steel industry, cutting capacity by at least one-third and modernizing the remaining plants to reduce energy costs and improve the quality of output. The installation of better environmental controls should be an absolute requirement for any plant that receives modernization investment. It is unlikely that any plants with open hearth furnaces will be modernized, so that the typical cost of new controls to meet

reasonable (but not strict) emission standards for air pollutants would amount to $20 million per 1 million tonnes per year of output capacity for a basic oxygen plant. This would cover all of the stages of steelmaking, including the sintering plant, coke ovens, furnaces and finishing.

Towns and cities with old steel plants have always been among the dirtiest areas in any country, whether in market or formerly centrally planned economies. Ambient levels of particulates are especially high, which leads to high levels of both acute and chronic respiratory disease as well as a variety of heart and other conditions. The damage done by particulates is usually exacerbated by relatively high ambient levels of sulfur dioxide and carbon monoxide. All of these health conditions can be alleviated by better air quality (even for longstanding sufferers), so that eliminating the pollution from steel plants will lead to a gradual improvement in the health of the local population. Thus, the benefits of investing in better environmental controls for steel plants are typically large because of the size of the population affected and the health gains that can be achieved in a reasonable period of time.

There is substantial scope for "win-win" investments in a combination of good housekeeping, better operating practices and greater energy efficiency which would also improve the environmental performance of those plants which continue to operate. For example, an evaluation of Ukraine's steel industry estimated that increased use of scrap could reduce coal requirements per tonne of finished steel by 20% or more. One operational measure that is standard in the West but is not used by most Ukrainian mills is the injection of tar, oil, gas or coal in the *tuyères* of the blast furnace to provide heat and reducing gas. This permits a saving of 100-200 kg of coke per tonne of pig iron. Other such measures include: heat recovery from the sinter cooler, installation of top pressure recovery turbines on blast furnaces (already used on one of Kryvyi Rih's furnaces), gas recovery from basic oxygen converters without combustion, and installation of regenerative burners and thermal insulation for heating furnaces. In many plants, process controls are primitive by comparison with Western facilities, so that the installation of better controls could have a substantial impact on energy and raw material use and on emissions.

Coal burnt by households and in small-scale boilers (c). Though the volume of coal burnt in power stations and large industrial plants is generally several times that used by households and in small scale boilers, it is the latter which are responsible for much of the local concentrations of particulates and sulfur dioxide in the majority of the most polluted urban areas in Central and Eastern Europe. For large boilers, it is possible, at modest cost, to install electrostatic precipitators or other dust filters to eliminate 98 percent or more of the particulate emissions. In any case, high chimneys and the relatively high velocities of such emissions disperse them over a relatively wide area *within* a country. In contrast, the emissions from burning coal on a small scale are not dispersed and cannot easily be controlled. Thus, in tackling excessive exposure to particulates, government or donor financing should concentrate on the use of coal in households, small commercial and industrial premises, and small district heating units (see **Box 3.3**).

This does not mean that emissions from power stations and similar large sources can be neglected, but rather that the solution for the large sources is clear—install and maintain appropriate electrostatic precipitators. The capital costs of these controls should be borne by the enterprises responsible for emissions and appropriate incentives provided either through pollution charges or with regulatory constraints. In due course the costs of environmental controls on power stations must be built into electricity tariffs, so that consumers bear the full cost of electricity including all environmental costs. The necessary adjustments in electricity tariffs to reflect long run marginal costs (LRMC) are much greater than the average increase in energy prices that is required to reach economic levels in all CEE countries—especially for domestic consumers—and governments have made less progress in this respect than for other energy prices. As a consequence, the financial situation of electricity utilities is often poor and they can ill-afford environmental investments. The best solution is to eliminate price controls since they are an inefficient instrument of social policy. If this is not possible, governments might consider providing special, repayable loans to finance the early installation or upgrading of filters on those power stations responsible for the worst pollution. Since the demand for electricity has fallen substantially in most countries and is unlikely to recover quickly, such finance should be provided only for power stations whose continued operation is supported by a least cost power planning study that takes proper account of environmental costs.

Studies of the damage caused by air pollution consistently identify the economic costs of average ambient levels of total suspended particulates in excess of 75 Tg/m^3 as one of the two largest components of the total damage. The other component is usually the loss caused by lead emissions, though such estimates are controversial because they depend critically upon the value attached to the lowering of children's IQ associated with excessive levels of lead exposure. In addition, high levels of particulates associated with the burning of coal have substantial material costs because of the soiling of clothing, buildings and other physical assets. Estimates of the total environmental damage caused by particulates in some countries of Central and Eastern are currently being reviewed and updated, but preliminary work suggests that the cost might amount to $750-1,000 million dollars per year in Poland. This damage is concentrated in the most polluted areas of Upper Silesia and a small number of other urban areas that have traditionally relied upon coal for domestic heating.

There are basically two ways of eliminating or, at least, drastically reducing the emission of particulates from small scale sources. The *first* is to require that all users burn *smokeless solid fuel* rather than ordinary coal

Box A6.2 Environmental investments in the iron and steel sector

The main sources of particulate emissions from iron and steel plants are materials handling and storage, coke ovens, the sinter plant, blast furnaces and steel converters. Most plants have reasonable facilities for primary gas collection and cleaning for coke ovens, sinter plants, blast furnaces and oxygen converters, especially where the exhaust gases are used to fuel other stages of the operation. Thus, attention must focus on secondary collection of fugitive emissions including those from charging and discharging steel converters. These emissions may be high because of poor maintenance or careless operating practices in the past and dealing with them will involve the installation of ventilation hoods, fans and filters or precipitators whose costs will be highly plant-specific.

Better arrangements for dust suppression are required, for example, at Kosice in Slovakia. Water sprays, partial enclosure of conveyor belts and other simple measures can reduce dust emissions, especially those generated by handling fine ores in dry and windy weather. The investment cost would amount to $1–2 per tonne of steel-making capacity or up to $10 million at Kosice.

At Kosice, all four units of the sinter plant have cyclones, while two have also had electrostatic precipitators fitted to the sinter breaker and screening areas but not to the sinter furnace. As a result, the emissions from the stacks at Kosice are dirty, and will almost certainly contain relatively large amounts of fine iron oxide dust. The solution to the problem, which is expensive, will involve changes in operating practice to improve the sinter quality, and the replacement of the ignition and filtration systems. The total cost of these measures applied to two of the units (two are expected to be closed) is estimated at $12–18 million. The sinter plant at Kryvyi Rih has a very bad dust problem, partly because it uses low quality waste and sludge from the iron beneficiation plant. A combination of better housekeeping, installation of fans with sufficient capacity to capture and clean waste gas prior to stack discharge and the use either of iron ore pellets or of higher grade fines could achieve large reductions in emissions. The plant management would like to invest in a new sinter preparation plant, but more limited investment to improve the existing unit would probably be justified.

Controlling particulate releases from coking ovens is largely a matter of good operation and maintenance. For example, adherence to a regular charging and discharging schedule and effective control of oven heating can assist in minimizing brickwork damage and hence gas leakage. Where plants have been poorly operated and maintained, significant repairs may be needed to affect a reduction in emissions. The coke ovens at Kosice, Kryvyi Rih, and Mariupil (the latter is located in the middle of a city of 500,000 people) display signs of age, misuse and the need for urgent repair. Most of the doors were leaking and there was a constant haze emanating from the top of the ovens. Detailed studies of the coke ovens would be required to determine the precise measures needed to reduce the emission levels but replacement or extensive rehabilitation of many of the coke batteries may be necessary in the medium term. This would be expensive, with a cost of $100 million or more for Kosice.

Improvement of primary particulate controls plus installation of secondary fume collection and cleaning for basic oxygen converters in existing plants may cost up to $10 per tonne of steel-making capacity. For example, the electrostatic precipitator on one of the Basic Oxygen System (BOS) units at Kosice was ineffective—the stack was emitting a thick plume which deposited red dust around the surrounding area—and may need repair or replacement at a cost of up to $8 million. It is unlikely to be worth investing significant sums in open hearth plants whose economic life is likely to be limited.

Prime candidates for environmental upgrading include the BOS units at: Kremikovtsi in Bulgaria; Trinec in the Czech Republic; Katowice and Kraków in Poland; Galati in Romania; Chelyabinsk, Cherepovets, Lipetsk, Magnitogorsk, Nizhniy-Tagil, Novokuznetsk and St. Petersburg in Russia; Kosice in Slovakia; and Kryvyi Rih, Mariiupil (both the Azovstal and the Ilyich plants) and Yenakiyevo in Ukraine.

or coal briquettes, while the *second* is to substitute some alternative fuel—normally *gas*—for coal. Reliance upon smokeless fuel involves little investment in the distribution of alternative fuels or in the installation of new boilers, so that it is relatively simple to achieve provided that the investment in carbonizing plants required to supply smokeless fuel is ensured. The difficulty is, however, that most households and other small users have a strong preference for gas over solid fuels, so that a market cannot be guaranteed for smokeless fuel plants while investments in gas distribution and conversion will, in any case, proceed in response to consumer demand.

An appropriate strategy would be to provide the resources required to accelerate the substitution of gas for coal in large, heavily polluted urban areas. In parallel, governments could adopt a policy of requiring the use of smokeless fuels in smaller towns whose average levels of particulate exposure during the heating season exceed some critical value—probably 150 Tg/m^3. The Gas Development Plan for Poland estimated that the total cost (at 1990 prices) of extending gas distribution for heating purposes to all urban areas would be about $5 billion over two decades to 2010. The population living in those urban centers worst affected by particulates amounts to about 6 million people out of a total urban population of 24 million, so that the cost of a priority program of gas conversion might amount to $1.25 billion if implemented over the remainder of the current decade; less than $200 million per year.

The full costs of such a program should eventually be paid by gas consumers who would benefit substantially from the wider availability of gas. Experience in many countries shows that households and other small scale users of coal are prepared to pay a premium for the convenience, cleanliness and labor-saving advantages of gas. Thus, the role of external donors should be (i) to provide technical assistance to minimize the costs of gas distribution programs, and (ii) to make available loans on conventional banking terms which would be repaid from the revenues of gas utilities in the usual manner.

Treatment/pre-treatment of wastewater from small industrial plants (d). In most parts of Central and Eastern Europe, it is usual for small and, sometimes, me-

Box A6.3 The impact of industrial pollution on municipal wastewater and sludge treatment: Case Studies

Nové Zámky, the Slovak Republic. The use of chemicals can be extremely effective in upgrading existing mechanical and biological plants. Nové Zámky in Slovakia is one of many plants in the CEE region which are highly overloaded in spite of the decreasing water consumption. Because the plant works at full capacity, action is needed regardless of the quality of the receiving downstream stretch of the Nitra River. The traditional enlargement of the existing biological plant would cost about $11–14 million. On the other hand, retrofitting costs to the mechanical-chemical-biological process would be only about $4–6 million. Such an upgrading would be able to cope with the high flow of industrial sewage (60% of total) and would be flexible enough to cope with the likely further reduction in water consumption. Sludge management is not adequate at present; any alternative would require an additional $1–2 million. The most cost-effective solution may therefore be to pre-treat the industrial effluent rather than to mix it with the municipal sewage.

Hradec Králové, the Czech Republic. The lack of pre-treatment of industrial wastewater causes serious problems when it comes to treating the sludge left over after wastewater has been treated. This is illustrated by a case study at Hradec Králové in Eastern Bohemia, where the sludge was to be used in agriculture. This was a common practice under the former large agricultural cooperatives and relatively lenient sludge quality standards. The situation has however changed significantly: (i) the state controlled farm cooperatives are being dissolved and land returned to its former owners; (ii) the government aims to minimize the transmission of sludge contaminants to humans through the food chain; (iii) there is greater understanding of the sources of sludge contaminants. A technical evaluation of the sludge disposal alternatives is planned. Components of the program will include development of a prototype pre-treatment program to improve sludge quality, a re-evaluation of disposal/use alternatives, an assessment of sludge dewatering technology, selection of specific disposal/use sites, and preparation of detailed cost estimates. The situation at Hradec Králové illustrates problems that occur throughout CEE countries: the quality of the sludge is poor due to a lack of industrial wastewater pre-treatment.

dium scale industrial plants to discharge their wastewater to municipal sewers. At a minimum, this can place a large burden on municipal wastewater treatment plants (where they are operating) and the nature of industrial effluent may severely reduce the efficacy of biological or other treatment processes. Since these industrial effluents may contain significant amounts of heavy metals, organic chemicals or heavy concentrations of COD and BOD, municipal treatment plants may also not be adequately equipped to prevent serious contamination of the receiving waters.

A crucial part of the long run strategy to deal with industrial wastewater from all industrial sources should be to encourage "win-win" investments in cleaner technologies which minimize both water use and waste generation. New, clean technologies reduce total emissions by 50 percent or more with no economic penalty. A combination of realistic charges for water consumption plus pollution charges based on the volume and characteristics of discharges to sewers will provide a strong incentive for the adoption of these technologies. Resources devoted to disseminating information and providing technical expertise relating to these technologies should produce substantial environmental and economic benefits.

Where there are concentrations of small industrial enterprises engaged in tanning, textile dyeing, electroplating or other metal processing activities in a town or city, the most cost-effective approach to environmental protection will be to invest in one or two industrial treatment or pre-treatment facilities designed specifically to remove the persistent, toxic and bio-accumulating substances. The total cost of such a facility will, of course, depend upon the precise nature of the effluent that it is designed to handle but it will rarely be large. As an example, a central facility to remove chromium, COD, BOD and other pollutants from the effluent produced by nearly 200 tanneries in Italy required a total investment of about $20 million to treat 10,000 m^3 of wastewater per day. At the same time, it is equally important to reduce the total volume of effluent to be treated by encouraging enterprises to switch to tanning technologies which do not rely upon chromium. On a smaller scale, a facility to treat 6,000 m^3 of wastewater from textile activities might involve an investment of $2–2.5 million.

Based on available data, discharges of industrial wastewater have not been a significant threat to human health in the region, because water authorities have been able to obtain water from unpolluted sources. To meet the demand for water they have had to incur increasing costs to pipe uncontaminated water to treatment plants, sometimes over considerable distances. At the same time, it is certainly the case that careless and unmonitored discharges of industrial effluent from small industrial plants have caused or may cause irreversible damage to groundwater in a number of industrial towns and cities. As the costs of treating such emissions centrally is relatively small, public investment to provide such facilities should generate a good return in terms of reducing environmental damage.

As for some of the other priorities, the case for public intervention and provision of treatment facilities rests on the difficulty of monitoring emissions from small industrial plants and of enforcing regulations or pollution charges designed to reduce emissions of the most damaging pollutants. The long run cost of operating central facilities should be recovered from the firms that use them, who should also be barred from discharging their effluent to public sewers. *By providing the initial funds required to develop central treatment plants, the government or external donors will provide the basis for local environmental authorities to take strong action against enterprises*

that neither treat their own discharges nor ensure that it is dealt with by a central plant.

Rural wastewater treatment (e). Excessive levels of nitrates in shallow wells and other sources of drinking water are a widespread problem in the rural areas of many countries in Central and Eastern Europe. However, as with many diffuse environmental problems, tackling it involves a large number of small measures designed to reduce discharges of nitrates and to ensure that groundwater sources used for drinking are protected from the infiltration of nitrates resulting from the careless disposal of human and animal wastes. These measures involve a large component of agricultural extension and public education as well as programs to finance the relatively small individual expenditures required to install septic tanks or simple systems to collect and treat wastewater in larger villages and small towns. The most important thing is proper legislation followed up by effective enforcement to ensure that the location, design, construction and operation of septic tanks meet the permit conditions. Without that, septic tanks are nothing more than point sources for groundwater pollution.

A short term program to reduce the incidence of methemoglobinemia among infants should concentrate on monitoring nitrate levels in the affected areas combined with public education and the provision of bottled water for families at risk. This is strictly a palliative approach, but it is necessary as an interim step because other measures to reduce levels of nitrates will take a long time to affect exposure levels.

Once the population is better protected from existing problems, policy should concentrate on reducing the flow of nitrates into groundwater, especially from intensive animal husbandry and rural housing. This need not involve substantial government expenditure on capital projects since much of the necessary finance should be found by the households and agricultural enterprises responsible for the offending discharges, but the nature of the problem means that a substantial commitment to demonstration projects, dissemination of good practice and the provision of advice will be required. It may also be necessary to offer grants or loans on special terms to speed up the necessary investments and changes in practice. Agricultural extension which explains how to reduce fertilizer applications can substantially reduce nitrate run-off from intensive arable agriculture, especially if it is combined with increases in fertilizer prices.

Rural communities will need different facilities according to their population, area and location. At one extreme there are scattered individual households for which proper septic tanks are clearly the solution, while at the other end are villages with 2,000-5,000 inhabitants that will require some kind of sewage collection network and a small scale treatment facility. In between, the appropriate solution will depend greatly on population density and the physical characteristics of the land (the cost of installing a collection network for a community of 500-1,000 people could easily dominate the cost of treatment facilities). The size of each community is not the only issue, since small but closely spaced communities could be served by a single treatment plant with interconnected collection networks. Natural treatment systems, such as artificial wetlands, can be used as low cost alternatives to conventional treatment if an appropriate site is available.

The immediate priority for public investment should be to ensure that the manure from feedlots, dairy and pig farms, and poultry units is properly managed, so that highly concentrated effluent is not allowed to seep into the ground and is not discharged into neighboring streams or rivers. Quite apart from the contribution such activities make to levels of nitrates in groundwater, they can have a devastating impact on river quality and aquatic life if the untreated liquors from manure heaps are simply piped into nearby surface waters. The responsibility for financing improvements in the treatment and disposal of manure is similar to that for other environmental problems caused by small or medium sized industrial enterprises. Over the long run, enterprises should bear the full costs themselves, but governments may find it difficult to privatize agricultural enterprises with an uncosted commitment to invest in environmental improvements. This implies that assessments of likely costs plus initial improvements might be financed by loans

Box A6.4 Rural Water Supplies

The question how best to provide rural households with access to safe drinking water gives rise to some difficult environmental choices in many parts of Central and Eastern Europe. As in many other countries, it is expensive to provide piped water to remote rural communities. Further, if piped water is installed, the level of water consumption per person tends to rise dramatically, which can lead to substantial problems in dealing with the resulting wastewater. In many communities the provision of piped water has far outstripped the capacity of existing septic tanks with the result that the quality of groundwater supplies, especially from shallow wells, is deteriorating rapidly.

The solution is not to deny piped water to rural communities, provided that they are willing to bear an appropriate share of the investment and other costs involved. However, these costs must include provision for expenditures that will be required to adequately dispose the resulting wastewater, so that water and sewerage are seen as joint rather than separate activities. Discounts could be given to those households which maintain adequate septic tanks whose outflows do not jeopardize neighboring wells.

For those households that cannot or choose not to be connected to piped water supplies, the crucial concern must be education about the importance of protecting their water supply—usually from a shallow well—from pollution caused by septic tank discharges. Intermittent monitoring of the quality of water from non-piped sources should also be carried out, so that measures to protect babies and other vulnerable individuals can be taken if required.

Box A6.5 The Application of Natural Treatment Systems: Szügy, Hungary

The village of Szügy, with a population of 1,200 and residential area of 74 ha, is located in rolling terrain in north Hungary. There is currently no piped water and no sewerage network in the village. Shallow dug ground-water wells are highly contaminated by nitrate, necessitating the partial supply of bottled water and usage of deep wells (shallow wells also continue to be used). Nitrate contamination originates from both fertilizer application and improper on-site sewage disposal.

The local government plans to obtain public water from the closest town, Balassagyarmat. Designs have been prepared for a wastewater sewer system and a natural root-zone treatment facility. The treatment will consist of pre-settling, root-zone method (RZM), and disinfection. The system is planned to be constructed on an area of 4 hectares owned by the local government. The filter beds will be installed in beds sealed with a 15-cm thick compacted clay layer. Reeds will be planted with shoots on a 40-cm by 40-cm grid.

The estimated construction cost is US$140,000. However, when the project was initially let out to bid, the local government received proposals for conventional primary/biological treatment plants that were about 30 to 80% more costly than the RZM proposal. The cost for the conventional plants ranged from US$180,000 to US$280,000. Operation, maintenance and repair (OMR) cost for the RZM system is about one-third that of the traditional system.

The feasibility of the RZM system was analyzed for six villages in a lowland region of the Slovak Republic near Bratislava. Populations in the six villages range from 400 to 2,200. Four alternative wastewater treatment systems were studied: (i) individual traditional biological treatment plants for each village; (ii) two similar regional plants; (iii) a single regional plant; and (iv) individual natural treatment systems for each village. Investment costs of the first three options ranged between US$1.4-2.0 million while the natural system would require only US$1.2 million.

made available now, subject to the conditions: (i) that such loans must be repaid when the enterprises are privatized, and (ii) that privatization is on the basis of making appropriate further investments to remedy any remaining problems. In some areas, where there are several enterprises in a particular locality, it may be sensible to invest in collective treatment and disposal arrangements and transport effluent to a central facility. Projects which provide finance and technical assistance for such facilities may be excellent candidates for support from donors.

Toxic, nuclear and other hazardous wastes (f). As for old wastes, experience from the West suggests that cleanup should be approached cautiously, and that *only those sites that could cause damage to water supplies or otherwise imply immediate danger to human health should be cleaned up right away.* Other sites should, as a rule, be cordoned off and carefully monitored with information being registered in a national inventory of waste sites. Inappropriate transport and disposal of dangerous substances could be riskier than leaving the sites untouched for the time being. Moreover, financial limitations in CEE countries argue strongly for this approach.[2]

Investments to deal with urgent problems specific to different countries

Municipal wastewater treatment plants (g and h). In many countries of the region there are numerous partially completed municipal wastewater treatment plants. It is, therefore, tempting to conclude that the completion of such plants should have a high priority under the Action Programme. While this may, indeed, be true for some such plants, there will be many that should not be completed, either because they were ill-conceived in the first place or because the resources could be better devoted to other objectives. The design of such plants was often predicated on assumptions about operating costs—for example about the price of energy—which are no longer valid, so that modifications in the proposed treatment method might be appropriate even where completion can be justified. Completing the plants would, in any case, often be expensive: the total cost in Poland has been estimated at over $1 billion, though the situation is much better in the Czech Republic. The expenditures necessary to complete partially completed plants should be assessed on exactly the same basis as other elements of the Action Programme. Bygones are bygones, so the issue is what are the net benefits from spending additional resources in this manner rather than on, say, control of particulate emissions in highly polluted towns and cities.

The two categories of wastewater treatment plants identified in items *(g)* and *(h)* of the list of investment priorities are placed there because they are likely to generate the largest benefits from any investment *in this sector.* However, the process of setting priorities is a complex one and the recommendations are intended as general guidance rather than specific precepts to be followed in all circumstances. The economic losses due to the pollution of beaches and of surface waters in other tourist areas can be large.[3] Equally, the long term costs of careless disposal of wastewater in areas of high ecological value are substantial, especially relative to the comparatively small expenditures that are required to protect these areas.

Deterioration in the quality of water in sources from which drinking water is abstracted can, in many cases,

2. In the U.S., only 63 of the 1,200 sites on the National Priority List of hazardous waste sites (32,000 potential sites have been identified) could be cleaned up during the last 12 years, at a cost of US$11 billion. Under the Superfund procedure in the U.S., it has been estimated that the cost of litigation has amounted to 55% of actual clean-up costs. Moreover, between 1986 and 1988, only US$166 million was recovered from private parties, or roughly 7% of the US$2.4 billion spent on Superfund cleanups.

be compensated by more stringent water treatment, but there may be a considerable economic cost involved. Where deterioration is associated with the presence of heavy metals or toxic organic compounds, the costs will be even higher since it will usually be necessary to seek out alternative water sources which may imply substantial additional investment or operating costs. Usually, such deterioration is a result of industrial activities, hence the emphasis on the protection of drinking water supplies in priority categories *(d)*, *(f)* and *(g)*. However, if lack of municipal wastewater treatment is the reason for a serious threat to the maintenance of drinking water supplies, then investment in an appropriate treatment plant should be regarded as having equal priority with investments in category *(d)*.

While large investments in municipal wastewater treatment will undoubtedly be required over the next two decades, it should always be borne in mind that measures to reduce the volume of sewer discharges can have a substantial impact on the scale of the resources required. A variety of measures—varying from dealing with leaks and dripping taps to the installation of low volume toilets—can reduce household discharges by 30–50 percent. Publicity, technical advice and even the provision of free plumbing services reinforced by the incentives provided by appropriate charging for water use and sewer discharges are all expenditures which bring environmental improvements and economic gains.

A broad range of wastewater treatment technologies is available that can be designed reliably to meet specified rates of removal and emission standards (see Box A6.6). The differences in capital and operating costs between wastewater treatment plants designed to achieve different levels of treatment are substantial. For a population of 100,000 the investment cost for mechanical treatment would typically amount to $10 million while chemical enhancement of existing mechanical treatment plants would add only an extra $2 million, but bring a significant improvement in BOD, SS and TP removal, and allow capacity expansion. Various levels of biological treatment would increase investment costs to between $15 million and $25 million. The amounts of different pollutants removed from the wastewater stream also differ. For instance, chemical enhancement significantly reduces the phosphorus content of the final discharge. Traditional biological treatment is more effective in reducing the BOD content while none of the above methods is really efficient in terms of nitrogen removal. It follows that *there can be no single best technological option, since the choice depends upon the quality of the receiving waters both at the point of discharge and further downstream.*

In the industrial countries plenty of experience is available on how to design, construct and operate treatment plants of various kinds. The starting point is always the standards set by legislation for effluent and, sometimes, ambient water quality standards—often attached to a given technology ("Best Available Technology"). The development of appropriate standards can take decades. The CEE countries face this process now. They should recognize the time span required, and plan to move towards West European standards over a period of 15–25 years as resources become available.[4]

The strategy suggested here is based on the multi-stage construction of wastewater treatment plants (in consonance with the gradual updating of standards). The first stage is aimed at the removal of organic matter and, in some cases, phosphorus where local conditions warrant it—e.g. the need to protect lakes. Later, extensions (for removing P and N in varying degrees depending on local and regional needs, standards, etc.) can be added as resources become available, since the original design should already have allowed for these process modifications. This is an unusual procedure in Western Europe where plants are generally constructed in one stage as a result of more relaxed financial constraints. In contrast, *the strategy advocated here implies building many wastewater treatment plants with medium removal efficiency rather than a few advanced ones with high removal efficiency.*

The same strategy applies also to the completion of unfinished treatment plants and the upgrading of existing ones. Chemical enhancement can be effective for upgrading both mechanical and overloaded biological treatment plants. Since it removes about one-half of BOD, the size and cost of any biological process can be significantly reduced (or the capacity increased). Innovative application of various chemicals in combination in low doses —such as metal salts and synthetic polymers—lead to a much smaller increase in the amount of sludge produced by comparison with traditional biological methods.

The results of work carried out in preparing the Action Programme[5] suggest that priority in the short-term should be given to ensuring that chemically-enhanced mechanical and/or biological treatment is installed wherever expenditure on municipal wastewater treatment is warranted. This implies that for most of the incomplete plants the appropriate action will be to spend limited sums in order to enable them to provide mechanical or chemically-enhanced mechanical treatment as soon as possible, while deferring any plans for more elaborate treatment until these can be assessed in the context of an overall plan for water quality management in the relevant river basin (or coastal zone). Small amounts of money spent in this way can achieve significant improve-

3. The local importance of the tourist and inshore fishing industries, together with the threat to groundwater sources used for drinking water from industrial discharges, are likely to justify high priority being given to municipal wastewater treatment in Istria, Croatia, and other localities along the Mediterranean coast, combined with measures to assure the pretreatment of industrial discharges from the chemical, metalworking and food processing industries.

4. It is worth noting that in OECD countries as a whole, 40% of the population (330 million people) are not served by wastewater treatment plants.

5. Details are provided in the technical report on *Municipal Wastewater Treatment in Central and Eastern Europe.*

Box A6.6 Types of wastewater treatment

Municipal wastewater treatment plants are designed to remove organic material (characterized by BOD), suspended solids (SS), phosphorus (P) and nitrogen (N) at required levels (depending on the type of receiving water, its desired quality and planned water uses). For this purpose, various physical, biological and chemical processes—or a combination of these—can be used. Examples are sedimentation, metabolizing organic compounds by bacteria, and precipitation.

- *Mechanical treatment* (*M*) removes particulate matter primarily by sedimentation in a settling tank.
- The addition of chemicals (prior to the settling tank) for precipitation enhances sedimentation, leading to *Chemically-enhanced Mechanical treatment* (*CM*) requiring practically no additional capital costs but still leading to significant upgrading (and good performance even in comparison to biological treatment).
- *"Traditional" Biological treatment* (*B*) incorporates an aeration basin after the settling tank in order to allow bacteria to oxidize a substantial fraction of the remaining organic wastes.
- *Biological-Chemical treatment* (*BC*) enhances biological treatment by adding chemicals to improve primarily the efficiency of phosphorus removal by precipitation and expand capacity.
- Finally, *advanced biological-chemical treatment* (*BCN*) incorporates an anoxic basin (oxygen is absent, but nitrate is available) for denitrification, and also sometimes an anaerobic tank for biological phosphorus removal. Chemicals may be added for increasing efficiency and improving economy. This method is the most expensive of the treatment options in terms of capital costs and requires careful management by specially trained staff.
- *"Natural" (extensive) treatment systems* (including artificial wetlands and the root-zone method) can be low-cost alternatives depending on site-specific conditions. The area requirement is larger than for the technologies mentioned above, but operation is simple. BOD and SS removal is acceptable, while P and N removal is not yet properly understood. (The Kis-Balaton reservoir at the inflow of the Zala River to Lake Balaton in Hungary operates partially as an artificial wetland, with positive experiences.)

The processes differ also in the composition, treatment and disposal of the sludge that they generate. The table below shows how the technologies differ in terms of their typical removal rates for BOD, Phosphorus, Nitrogen, and Suspended Solids, and the associated capital and operating costs.

Treatment Process	*Typical Removal Rates (%) for:*			
	BOD	*Total Phosphorus*	*Total Nitrogen*	*Suspended Solids*
Mechanical (M - primary)	30	15	15	60
Chemically-enhanced mechanical (CM)	55-70	75-90	25-30	80-90
Traditional biological (B - secondary)	90	30	30	90
Biological-chemical (BC - secondary)	90-95	90-95	35	90-95
Advanced (BCN)	95-97	90-95	60-85	90-95

	Typical Costs (Mechanical Treatment = 1)		
	Capital Costs	*Annual OMR Costs* [a]	*Total Annual Costs* [b]
Mechanical (M - primary)	1.0	1.0	1.0
Chemically-enhanced mechanical (CM)	1.1-1.3	1.6-1.9	1.3-1.5
Traditional biological (B - secondary)	1.8	1.7	1.8
Biological-chemical (BC - secondary)	1.7-1.9	2.2-2.6	1.9-2.1
Advanced (BCN)	2.1-2.6	2.6-3.3	2.3-2.9

a. OMR = Operation, Maintenance, and Replacement (includes dewatering and anaerobic stabilization for sludge treatment).
b. OMR plus amortization of capital costs @ 12% interest rate over 20 years of economic life.

ments in water quality and amenity, while attempts to follow the original plans are likely to be frustrated by lack of resources and may generate little in the way of additional benefits in the form of better water quality and amenity (see **Box 4.3**).

The approach of updating standards gradually and relying upon multi-stage technology must be complemented by careful planning at a water basin or sub-basin level in order to maximize the impact of expenditures on water quality. The management of water quality in a river basin should be regarded as an exercise in system planning similar in character to the planning of a power system. Both are complex, highly-interrelated systems which need to be analyzed as a whole rather than treating each investment decision as if it could be decided on the basis of limited local information. It is, therefore, inappropriate to impose uniform emission or technological standards on all municipal wastewater treatment plants within a river basin. A more flexible approach will be required in order to achieve long run improvements in the water quality of rivers in Central and Eastern Europe at a cost that can be afforded by the countries concerned (see **Box 4.5**).

Box A6.7 Priorities and alternative technologies: Case study of an overloaded municipal wastewater treatment plant

The municipality of *Zvolen in the Slovak Republic* (population 42,000) has a high level of water and wastewater infrastructure: more than 95% of the population is connected to the water supply system and the combined sewer network. Because of poor construction of the sewer system, groundwater infiltrates the sewer system and adds to the volume of waste water. Industrial wastewater represents about 20% of the total. The existing treatment plant is 18 years old and has a traditional primary and biological (Activated-Sludge Process) design. The plant should handle about 250% of the amount of water for which it was originally designed, and 150% of the BOD load. More than 10,000 m^3 per day is discharged to the Hron River without any treatment.

Several alternatives to solve the existing treatment problems are being discussed. Investment costs for treatment (including sludge management) range from US$26–30 million. The annual operation, management and repair (OMR) cost is around US$2–2.5 million based on the assumption for all options that the original capacity will be expanded by 50%. Funds are not available for the treatment upgrade and space is limited.

However, the planned capacity expansion is probably not needed. If the sewer rehabilitation is completed, groundwater infiltration will diminish. A further flow reduction is anticipated due to increasing water prices. As a result, it is estimated that the future discharge may be reduced by about 40 to 50%.

Thus, the best alternative may be to upgrade the first stage of the plant to chemically-enhanced primary treatment and retain the existing activated sludge unit. If the ongoing extension of the final clarifier is completed (at an investment cost of slightly below US$3 million, including the costs associated with the increase in sludge production and treatment, and an annual OMR cost of around US$1.5 million), this treatment scheme will meet both the existing standards and those proposed for 2004.

The solution is about ten times less expensive than the alternatives currently being discussed, and little additional area is needed for construction.

Biodiversity conservation priorities (i). Since the most polluted areas are relatively well-defined and do not evenly cover all of Central and Eastern Europe, it is possible to prevent deterioration in those areas that are relatively untouched—at a fraction of the costs of the investments required to address the main pollution problems. This is true especially for some of the remaining large, contiguous unspoiled areas (such as the Mazurian Lakes in northeast Poland and parts of the Taiga in Russia), and for the remaining wetlands which, according to recent studies, are the most vulnerable ecosystems in the CEE region. As part of conservation measures for such sites, investments should ensure above all that tourism and other facilities in pristine areas meet rigorous standards for waste water treatment. Revenues from tourism and other recreation activities could provide funds for investment and maintenance expenses in protected areas.

Where protected areas are located in polluted zones (e.g., in Poland, 6 out of 18 national parks are located in regions of "ecological disaster" or "ecological hazard"), conservation of living natural resources requires, in the first instance, the same kinds of measures as are called for to address the impact of environmental degradation on human health. In some cases, and only if no other possibilities are available, *ex situ* conservation of species through special measures (e.g., creation of gene banks) may be called for.[6] With regard to protected areas, the basic premise is that investments should focus on establishing and funding integrated management plans for existing designated areas. Standard procedures for environmental impact assessment should be used to ensure that new activities do not adversely affect the conservation values of these areas.

In Western Europe, biodiversity conservation is concentrated on 10% of the land area which cannot easily be isolated from the encroachment of nutrients and pollutants from intensive agriculture on the remainder of the land area. Hence, even if all existing protected areas (in Western or Eastern Europe) were managed in exemplary fashion, conservation could not be assured. It is therefore not enough to improve the management of protected areas alone; to prevent irreversible loss of species and habitats requires awareness and actions in agriculture, tourism, and industry. In other words, conservation should be embedded in all economic activity.

CEE countries, in collaboration with the Council of Europe and IUCN, have proposed five site-based projects in areas of outstanding biodiversity as examples of an integrated approach serving both conservation and development objectives (see **Box 5.4**). Another 22 projects from the region have been proposed and are being discussed. A complete picture of the areas that are or should be protected will not emerge until completion of the CORINE extension to CEE countries, the work in CEE for the State of the Environment Report, and completion of the IUCN ecosystem surveys.

GREEN LUNGS OF EUROPE PROPOSAL. In March 1992, Environment Ministers of Belarus, Lithuania, Latvia, Poland, Russia, and Ukraine established a working group to prepare a proposal for a Green Lungs of Europe program aiming to protect regions in those countries richest in biodiversity.[7] The program has its roots in the concept of the Green Lungs of Poland—the north-eastern part of the country that remains largely unharmed by industrial pollution. The Green Lungs of Europe pro-

6. A project financed by the Global Environment Facility (GEF) is underway in Poland to provide institutional support for biodiversity conservation management activities and a forest gene bank to conserve tree species found in the old-growth Bialowieza National Park.

Box A6.8 Environmental investments in the paper and pulp sector

The composition of pulping processes installed in CEE countries is broadly comparable with that for West European plants, though few plants are designed to use recycled paper. Thermo-mechanical pulp making has been adopted more rapidly in Western Europe while the much lower demand for packaging materials in the CEE region has favored the use of simple chemical or mechanical processes rather than combined semi-chemical processes.

The environmental problems of CEE pulp mills seem to be particularly associated with the control of wastewater treatment plants and the treatment of condensate liquors from chemical pulping. Primitive controls – for managing the pulping process as well as treating wastewater – combined with very limited adoption of water recycling means that CEE plants tend to waste much more energy and water than their Western equivalents. Other techniques, such as steam stripping of condensates and black liquors in Kraft and sulfite plants, could pay for themselves by reducing energy costs while also lessening the burden on wastewater treatment facilities. The costs of such measures varies greatly from plant to plant but an investment of $2-3 million for a plant producing 50,000 tonnes per year should permit significant improvements in both efficiency and environmental performance.

Chlorine-based bleaching is believed to be a significant source of pollution from many CEE kraft mills since they have not been subject to the increasingly stringent emission standards applied to most Western plants with respect to emissions of chlorinated and halogenated organic compounds (known as AOX and including such compounds as pentachlorophenol and dioxin). AOX emissions cannot be eliminated but they can be largely removed from wastewater and disposed of safely in solid form. Further, a variety of options are available to minimize the amount of AOX produced – this can run to 1-1.5 kg per tonne of pulp with chlorine bleaching of kraft pulp. Pre-bleaching technologies such as improved pulp washing, exclusion of condensate liquors from wash waters, extended cooking in the digestion stage, oxygen addition to reduce the lignin content of pulp, and better process control rely more on process modifications rather than end-of-pipe controls with potentially large investment requirements.

A case study of the Sloka pulp plant in Latvia, which primarily produces chemical pulp using a sulfite process, showed that the plant's principal environmental problem concerned emissions of various organic compounds such as lignosulfonates and phenols. The plant would benefit from better process controls, though their main benefit would be economic since they would reduce energy and material inputs and improve output quality. Separate treatment of condensate liquors would involve an investment of $2-2.5 million, but the cost could partly be recovered by burning the methane and distillate produced. The lignosulfonate problem arises because the wastewater treatment plant cannot degrade this material efficiently, so that it would be better to remove and reprocess it in solid form. Both the cost and the economics of any investment in such reprocessing are highly uncertain.

Chemical pulp plants can be highly unpleasant neighbors because of the malodorous nature of their gaseous emissions even though the gases emitted are generally not hazardous to health. An investment of $0.5-1 million can reduce emissions of hydrogen sulfide, other sulfur compounds and aromatic VOCs to air by 80% or more.

posal foresees the development of sustainable practices in all productive sectors.

NATURAL RESOURCE AND FOREST MANAGEMENT. Some temperate forests are as rich in species as tropical forests although the diversity is not in the tree species themselves but in the organisms which inhabit or depend upon them. Russia contains 42 percent of the world's temperate forests. A recent WWF study has found that the most serious threat to temperate forests is logging.

Economic pressures and lack of capacity to enforce legislation is enabling timber exploitation to proceed in protected areas. This is a matter of great concern in Russia because of the threat to the Taiga from uncontrolled logging, but similar considerations apply in other countries and to the exploitation of mineral and fishery resources.

External resources and technical assistance is required to enable governments to redirect the activities of Departments of Forestry and Natural Resources and to retrain their staff as well as to introduce new legislative and regulatory regimes governing the use of these resources. In the case of forestry this will involve the introduction of stumpage fees plus a combination of incentives and regulations to ensure that privatized forestry and logging operations manage their resources in a sustainable manner and that an appropriate share of the resource rents accrues to the government. The experience of other sub-Arctic countries would be especially useful as a basis for providing the necessary technical assistance. Technical and financial support for sustainable use and protection could be directed through national Biodiversity Conservation Strategies.

In some areas, it may be possible to generate the resources required to enhance the management of national parks and protected areas from the user fees and tourism taxes that can be earned by encouraging ecologically-sensitive tourist development. Care must be taken to ensure that such revenues do not just disappear into the general budget of either national or local government and that a reasonable share of the revenues is reinvested to protect the natural, ecological and other characteristics that provide the basis for tourist development.

Low-cost measures to address longer term environmental problems

Traffic (j), (k) and natural resource management related concerns (l) are either cases where the maxim that *prevention is much cheaper than cure* applies or where it is necessary first to develop a proper understanding of the environmental processes involved before making any substantial commitment of resources. The amounts of

7. Estonia joined the working group in February 1993.

public expenditure involved will be small. Technical assistance, training and research support are the obvious areas where external donors can support these measures.

There are numerous policy options available for the control of emissions from transport sources which can be grouped in three broad categories:

- Measures to reduce or limit the growth of vehicle traffic, such as parking fees and prohibitions, fuel taxes, vehicle emission taxes, urban tolls, area/corridor licensing, and land-use planning to reduce the volume of traffic from residential to commercial areas. Measures aimed at commercial vehicles including mandatory night-time deliveries, and user charges;
- Traffic management, including measures such as car-free zones, computerized traffic signals, traffic routing, and parking enforcement.
- Measures to limit emissions per vehicle-km. These include emissions controls, fuel-efficiency standards, and fuel quality standards. For vehicle emissions standards to be effective, countries must have in place inspection and maintenance programs.

Pollution abatement strategies should be tailored to each city, and to its level of emissions and air quality. Much more research on the cost-effectiveness of various policy options is also needed. However, even in the absence of detailed information, it is possible to suggest some priorities:

- Since high blood-lead levels have been recorded in several cities in CEE, and since the benefits of reducing lead emissions almost certainly outweigh the costs, reducing lead emissions from transport sources should be a priority. Cost-effective measures may include: (i) taxing fuels differentially according to lead content, and (ii) reformulating the leaded grade of motor fuel;
- Since the vehicle stock in CEE is, on average, old (in Hungary, 42% of passenger cars are over 10 years old, and 62% are over 7 years old), poorly maintained, and includes a high proportion of cars with highly polluting two-stroke engines (in Hungary, two-stroke engines comprise nearly one-third of the vehicle fleet), cost-effective strategies may involve targeting these vehicles. Possible measures may include an ownership tax which rises as the vehicle ages and an ownership tax on vehicles with two-stroke engines. Alternatively, governments may offer subsidies for scrapping vehicles or incentives (such as tax breaks) for the acquisition and use of "clean" cars; the latter approach has been practiced in a number of Western European countries as a transition measure before making control technology (such as catalytic converters) mandatory. Now that new EU and UN/ECE regulations require strict emission controls from 1994, CEE countries may wish to adopt these standards for *new* motor vehicles;
- Because of their intensive use, the amount of pollution emitted by buses, trucks, and taxis is very high in relation to their proportion in the vehicle fleet. Therefore concentrating on high-use vehicles may be a cost-effective approach for many urban areas. A recent study comparing options for the control of emissions from mobile sources in Budapest concluded that the least expensive way is to replace standard diesel bus engines with "clean" engines (which are also more fuel efficient than standard engines). Another study showed that retrofitting high-use vehicles such as trucks to operate on "clean" fuels such as liquid petroleum gas or compressed natural gas may be cost-effective for some cities. Finally, it may be cost-effective to target taxis for emission controls.
- It may be correct to *discourage* a large shift of freight transport from rail to road. In part this can be achieved by ensuring that trucks bear the full cost of the environmental and congestion externalities that they cause in the form of heavy license fees and fuel taxes. One promising measure is to finance the development of rail container-handling facilities, since it is the cost of transferring freight from road to rail or vice-versa which has discouraged the combination of long distance rail freight with local road distribution in Western Europe. In general, modal transport (the use of containers and truck-trailers which can easily be moved from road to rail and back to road for local distribution) tends to be a very cost-effective way to simultaneously address transport and environmental objectives. Of course, in large countries with long average hauls such as Russia, rail will continue play an important role in freight transport so long as its efficiency is improved and emphasis is given to the timely delivery of valuable and time-sensitive cargoes.

Measures to strengthen public transport, including subsidies, are often proposed in West European cities as a way of reducing environmental damage caused by urban traffic. However, in Central and Eastern Europe most cities already have extensive public transport networks, though some require substantial rehabilitation. Their main problem is a continued reliance upon government subsidies when public expenditure is under extreme pressure. The solution, which has already been tried in some CEE countries, is to raise fares substantially in order to finance the modernization of bus fleets (diesel buses are a big source of traffic pollution) and to enhance the quality of service offered. Reliable and frequent service is the decisive factor in persuading people to continue using public transport. At the same time, automobiles and trucks should bear the full cost of the environmental damage that they cause as well as the infrastructure they require. Fuel taxes, vehicle license fees, parking charges and even road user charges for vehicles operating in congested city centers are all possible elements of a package designed to internalize the costs associated with vehicle use. If such a package is implemented, the case for additional public spending on public transport is weak, since the experience of the rich countries suggests that such expenditures have only a marginal effect in shifting passengers and freight from private vehicles to public transport.

Box A6.9 Environmental investments in the chemicals sector

Chemicals and petrochemicals plants in Central and Eastern Europe vary widely in age. Many would probably have been shut down some time ago in the market economies. For example, PVC plants based on an acetylene route are unlikely to be able to compete directly against ethylene-based processes now standard in the West. Older plants were often designed with limited pollution controls or before the dangers associated with certain chemicals were fully appreciated – e.g., the carcinogenic monomer VCM produced in PVC plants. Finally, the state of maintenance of older plants is often poor, so that simple "good housekeeping" measures can do much to reduce spills and leaks that are the source of substantial emissions – e.g., refinery emissions of VOCs from leaks in heat exchangers into cooling waters, or large styrene losses from driers. The investment cost of achieving these improvements in maintenance and operating practices is typically small – less than $5 million even for large plants.

Inorganic chemicals. Chlor alkali plants relying upon mercury cells account for 10–15% of total emissions of mercury in the CEE countries. Emissions can be almost eliminated by switching to membrane cells, but this is a relatively expensive option – though a case study of PO Kaustik in Russia revealed a plant in Volgograd which had the necessary equipment but lacked the funds to install it. A combination of minor equipment modifications to recover lost mercury, better operating practices and possible conversion from graphite to titanium anodes would permit substantial reductions in emissions (of the order of 80–90%) at a cost of about $6 million per plant or about $200 million for all plants in the region. Among the large emitters which should receive priority in the allocation of such funds are: Dzerzhinsk, Volgograd, Berezniki and Sterlitamak in Russia; and Lyssychansk in Ukraine. (The latter has serious dust emissions which could be reduced by better housekeeping and attention to reducing dust during conveyance.)

Borsod Chem in Hungary was another plant studied. This used to emit substantial quantities of mercury to both air and water, but air filters and better water treatment combined with water recycling have largely eliminated these emissions, though there is still a need to dispose safely of sludges and other solid wastes containing mercury. Past practices have left a legacy of contaminated land, especially below the electrolysis unit. Mercury has largely been washed out of the river sediment in the section of the Sajo river downstream of the plant and there seems to be no serious problem of groundwater contamination. Some investment may be warranted to prevent further intrusion of mercury from the electrolysis unit into the ground underneath, but measures to deal with existing soil contamination should probably be deferred until more is known about the extent and nature of seepage from the site into ground or surface waters.

Synthetic soda ash plants using the Solvay process generate a large volume of saline water effluent which is difficult to deal with. Most inland CEE plants discharge their effluent – typically 1,000–2,000 tonnes per day containing up to 15% of chlorides – into nearby rivers. This can cause serious damage. Solutions rely upon use of settling lagoons, extraction of lime solids plus the return of concentrated brine to spent brine cavities (assuming that solution mining is the source of the brine feedstock). Lagoons must be carefully constructed and managed to avoid contamination of nearby soils and groundwater. The total cost of such measures would amount to $8-12 million for a plant producing 500,000 tonnes of soda ash per year. A modest part of this cost can be recovered from the sale of lime from lime beds. Plants where some or all of these investments have high priority include Govora in Romania, Bashkiria in Russia and Lyssychansk in Ukraine.

Air emissions of hydrogen fluoride from the processing of phosphate rock are the principal problem associated with the production of phosphoric acid for fertilizers. Most CEE plants have relatively low efficiency absorbers which could be replaced by high efficiency Venturi scrubbers at a typical cost of $0.5–1 million. Plants where such an investment may be justified include: Gomel in Belarus; Kedainiai in Lithuania; Gdansk in Poland; and Balakovo, Cherepovets, Krasnodar and Voskresensk (Moscow) in Russia.

Organic chemicals. The main environmental problems are to be found in plants producing ethylene intermediates

including PVC. There are a number of acetylene-based PVC plants in the CEE region which are both uneconomic and produce substantial dust emissions; they should be closed down as quickly as possible. For ethylene-based plants concern focuses on emissions of vinyl chloride monomer (VCM) and of other chlorinated organic compounds. VCM is a carcinogen which is primarily a threat to plant workers but may pose a threat to those living near to PVC plants. Emissions depend partly on plant design, on the collection and treatment of vent gases, the extent of fugitive emissions, and on the method of dealing with slurry from the recovery vessel. The most cost-effective way of reducing VCM emissions include: (a) the minimization of losses in the VCM recovery system; (b) carbon adsorption of VCM from vent gases; and (c) steam stripping of VCM from slurry. The total investment cost of these measures would amount to $10–12 million for a plant producing 75,000 tonnes per year of PVC. A further $3–6 million would be required to install a proper high-temperature incinerator to deal with chlorinated organic residues. Plants where such an investment may be justified include: Devnia in Bulgaria; Usti nad Labem in the Czech Republic; Wloclawek in Poland; Tula in Russia; Novaky in Slovakia; and Lyssychansk and Severo-Donetsk in Ukraine.

The case studies indicated that investment in an incinerator to dispose of chlorinated effluents would be a very high priority at PO Kaustik in Volgograd. An appropriate unit could serve the whole Volga basin whose ecosystem is increasingly threatened by water discharges containing a variety of chlorinated hydrocarbons. Other changes in operating practices including the separate treatment of water effluents from different sources within the plant, and a steam stripper for the PVC unit would also reduce emissions of chlorinated organics.

The Chimcomplex and Carom plants near Onesti, Romania, share a wastewater treatment plant that is overloaded and is suffering from substantial corrosion. There are plans to upgrade this plant—at a cost of $10–15 million—but an expenditure of $1–2 million on centrifuges and presses could reduce the volume of suspended solids and BOD in water sent for treatment. A further expenditure of up to $5 million on process controls, better maintenance and simple upgrading should result in substantial reductions in both air and water pollution together with lower operating costs.

Refining and petrochemicals. One important type of emissions from refineries and petrochemical plants is of miscellaneous VOCs to air and hydrocarbons in water effluent. Some aromatic organic compounds, notably benzene, may be a severe threat to the health of plant workers in certain CEE plants and there are concerns about general levels of benzene exposure in a number of Russian cities. A combination of improved seals on equipment plus floating roof covers on storage tanks offers something close to a "win-win" solution to the most serious leakages of VOCs. Costs depend greatly on the design and capacity of the plant concerned but $0.5–1 million should be sufficient for a typical plant producing benzene, toluene or xylene while up to $10 million might be required for a refinery processing 10 million tonnes of oil per year. Reductions in product losses should certainly be sufficient to repay the cost of the latter investment within a short period. For Plock in Poland the total cost of such investments might amount to $15 million covering both the refinery and the petrochemical plant.

Water discharges from refineries may be contaminated with oily wastes while wastewater treatment plants tend to accumulate sludge containing a mixture of heavy oil and other chemicals. Quite large investments—of the order of $20–40 million—are required to deal with these emissions but the oil recovered can either be burnt or converted to other products that can be sold to recover much of the cost. Good housekeeping practices, especially the separation of effluent streams, can reduce the volume of such wastes and the associated losses of products. A case study of the Burgas refinery in Bulgaria showed that an expenditure of $5–6 million on improving the plant's separators, its sewer system and its wastewater treatment plant could substantially reduce water emissions to the Bay of Burgas and thus to the Black Sea.

LOW-COST ENVIRONMENTAL INVESTMENTS
Indicative Listing of Possible Actions

Industry	*Problem*	*Technologies/Actions*	*Typical Costs per Plant (US$)*	*Potential Locations*
NONFERROUS METALS INDUSTRY				
Lead & zinc smelters	• Lead emissions which can affect children living within a large radius of the plant; • SO_2 emissions from sulfuric acid plants	• Install Water sprays to damp down stockpiles • Install of perimeter walls, plus other measures to prevent spillage • Install new hoods, & baghouse filters; repair & modernize old controls • Repair & upgrade sulfuric acid plants to process more of the sinter plants gases • Install devices to contain zinc powder when dumping from hoppers to carriages & when unloading at screening station; utilize industrial vacuum cleaner	100,000 2 million 2 million 3-4 million (Copsa Mica); 6-8 million (Plovdiv) 10,000	• Bulgaria: Plovdiv • Romania: Copsa Mica • Poland: Bukowno, Szopience & Olkusz • Russia: Ordzhonikidze & Chelybinsk • Poland: Silesia Metallurgical Works, Katowice [1]
Copper smelters	Lead and arsenic emissions	• Install new dust controls -- ESPs, scrubbers, baghouses • Upgrade existing facilities • Initiate water treatment & measures to prevent leaching from solid wastes	5-10 million 2-3 million 10-15 million	• Armenia: Alaverdi • Bulgaria: Pirop • Poland: Glogow & Legnica • Romania: Baia-Mare • Russia: Krasnouralsk, Kushtym, Mednogorsk, Pyshma & Sredneuralsk • Slovakia: Krompachy
Aluminum smelters	Emissions of pot-gases containing tar, fluorine, & particulates	• Install low-cost measures to reduce dust losses of bauxite & to improve plant controls hygiene • For plants likely to remain viable, install potroom refits to eliminate fluorine emissions	2-3 million 50-100 million	• Slovakia: Ziar nad Hronom • Russia: Kamensk, Krasnoturinsk, & Volgograd • Ukraine: Zaporozhe
IRON AND STEEL PLANTS				
Iron and steel plants	Particulate emissions, especially secondary emissions from charging and discharging steel converters	• Install ventilation hoods, fans & filters, or precipitators • Install water sprays and/or partially enclose conveyor belts to reduce dust emissions, especially during dry and windy weather • Change operating practices to improve sinter quality; upgrade or replace ignition & filtration systems • Install fans with sufficient capacity to capture & clean waste gases prior to stack discharge; use iron ore pellets or higher grade fines	plant-specific 1-2 per tonne of steel-making capacity 12-18 million 50 million	• Ukraine: Krivoi Rog • Slovakia: Kosice

Coking ovens	Particulate emissions	• Improve operational & maintenance procedures e.g. by adhering to a regular charging & discharging schedule & control over oven heating • Replace or rehabilitate coke batteries	100 million	
Basic oxygen converters	Particulate emissions	• Improve primary particulate controls & install secondary fume collection	10 per tonne of steel-making capacity (8 million for Kosice)	• Bulgaria: Kremikovski • Czech Republic: Trinec • Poland: Katowice & Krakow • Romania: Galati • Russia: Chelyabinsk, Cherepovets, Lipetsk, Magnitogorsk, Nizhniy-Tagil, Novokuznetsk, St. Petersburg • Slovakia: Kosice • Ukraine: Mariupol & Yenakiyevo
PAPER AND PULP MILLS				
Paper and pulp mills	• Discharge of condensate liquors • Emissions of chlorinated & halogenated organic compounds (AOX) • Emissions of lignosulfonates & phenols • Emissions of hydrogen sulfide, other sulfur compounds, & aromatic VOCs	• Initiate steam stripping of condensates & black liquors in Kraft & sulfite plants • Remove AOX from wastewater & dispose of solids; minimize amount produced using pre-bleaching technologies such as improved pulp washing, exclusion of condensate liquors from wash waters, extended cooking in the digestion stage, oxygen addition to reduce lignen content of the pulp, & better process control • Treat condensate liquors • Reduce water usage by: recycling, installing control devices, continuously supplying water from thickeners to wastepaper plant; install hydrocyclones, reuse water from compressor station & vacuum pumps, separate fibers from water, treat water from thickeners for reuse	2-3 million (plant producing 50,000 tonnes/yr) 2-2.5 million 1.5-2 million	• Latvia: Sloka • Poland: Swiecie Cellulose & Paper Works [1]
CHEMICAL AND PETROCHEMICAL PLANTS				
Chemical & petrochemical plants	VOC discharges	• Improve operating & maintenance procedures	< 5 million	

LOW-COST ENVIRONMENTAL INVESTMENTS *(continued)*
Indicative Listing of Possible Actions

Industry	*Problem*	*Technologies/Actions*	*Typical Costs per Plant (US$)*	*Potential Locations*
Inorganic chemical plants	Mercury discharges	• Undertake minor equipment modifications to recover lost mercury; implement better operating practices, & possibly convert from graphite to titanium anodes	6 million	• Bulgaria: Devnia • Poland: Oswiecim • Russia: Dzerzhinsk, Volgograd, Berezniki, Sterlitamak • Ukraine: Lysichansk
Synthetic soda ash plants	Saline water discharges	• Construct settling lagoons; extract lime solids; & return concentrated brine to spent brine cavities	8-12 million (plant producing 500,000 tonnes soda ash/year)	• Romania: Govara • Russia: Bashkiria • Ukraine: Lyshchansk
Phosphatic fertilizer plants	Hydrogen fluoride air emissions	• Install high efficiency Venturi scrubbers	0.5-1 million	• Belarus: Gomel • Lithuania: Kedainiai • Poland: Gdansk • Russia: Balakovo, Cherepovets, Krasnodar, Voskresensk (Moscow)
Organic chemical plants	Emissions of vinyl chloride monomer (VCM) & other chlorinated organic compounds	• Minimize losses in the VCM recovery system; install equipment for carbon absorption of VCM from vent gases; implement steam stripping of VCM from slurry • Install proper high-temperature incinerator to deal with chlorinated organic residues • Install centrifuges & presses to reduce suspended solids & BOD in water sent for treatment (a further expenditure of 5 million on better process controls, maintenance, & simple upgrading will reduce air & water pollution and allow lower operating costs)	10-12 million for a plant producing 75 tonnes/yr of PVC 3-6 million 1-2 million	• Bulgaria: Devnia • Czech Republic: Usti nad Labem • Poland: Wloclawek • Russia: Tula • Slovakia: Novaky • Ukraine: Lysichansk, Severo-Donetsk • Russia: PO Kaustik in Volgograd • Romania: Chimcomplex & Carom plants near Onesti
Refining & petrochemicals	• VOC emissions • Hydrocarbon discharges	• Install improved seals on equipment & floating roof covers on storage tanks	0.5-1 million (plant producing benzene, toluene or xylene); 10 million (refinery processing 10 million tonnes of oil/yr)	• Poland: Plock (15 million for both the refinery & petrochemical plant)

Refineries	Oily discharges	• Initiate good practices, e.g. separation of effluent streams; improve sewer systems & wastewater treatment plants • Optimize clay dosage with automated process control; improve batching facility; optimize oil storage; incinerate in the factory power plant after coating the coal with a water suspension of the clay	5-6 million 8,600	• Bulgaria: Burgas • Poland: Silesian Refinery Works, Czechowice-Dzce [1]
MUNICIPAL WASTEWATER TREATMENT				
New wastewater treatment plants	Sewage discharge	• Consider chemically-enhanced primary treatment	18 million for a town of 200,000, e.g. Szeged, Hungary	
Overloaded plants with significant industrial pollution		• Require pre-treatment of industrial waste before discharge to municipal wastewater treatment plants • Upgrade traditional treatment plants to chemically-enhanced primary treatment	5 million (including sludge treatment) in a town such as Nove Zamky, Slovakia	

1/ Being implemented as part of the Norwegian transfer of know-how programs in waste-minimization.

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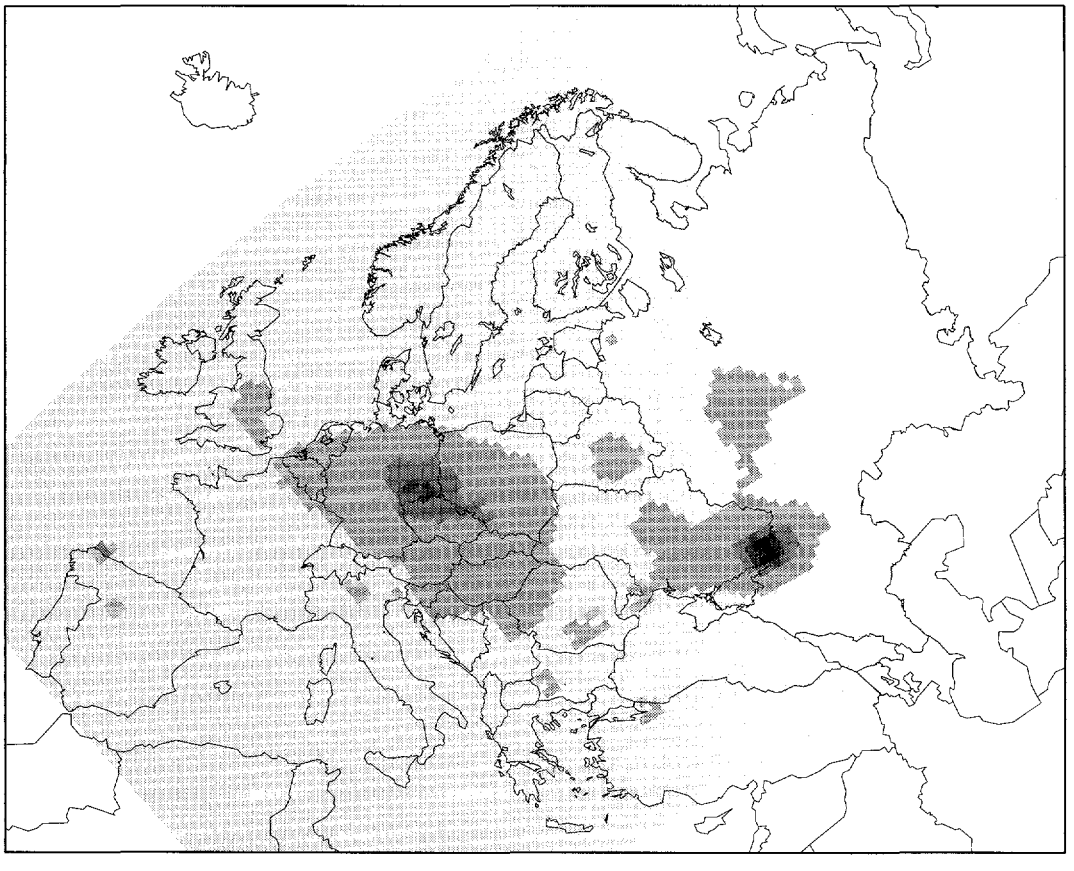
CENTRAL AND EASTERN EUROPE

CONCENTRATION OF TOTAL DUST
AVERAGE CONCENTRATION IN 1990



MICROGRAM PER CUBIC METER:

- < 20
- 20 - 40
- 40 - 60
- 60 - 90
- > 90

Computations: RIVM

MAP 1

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MARCH 1994

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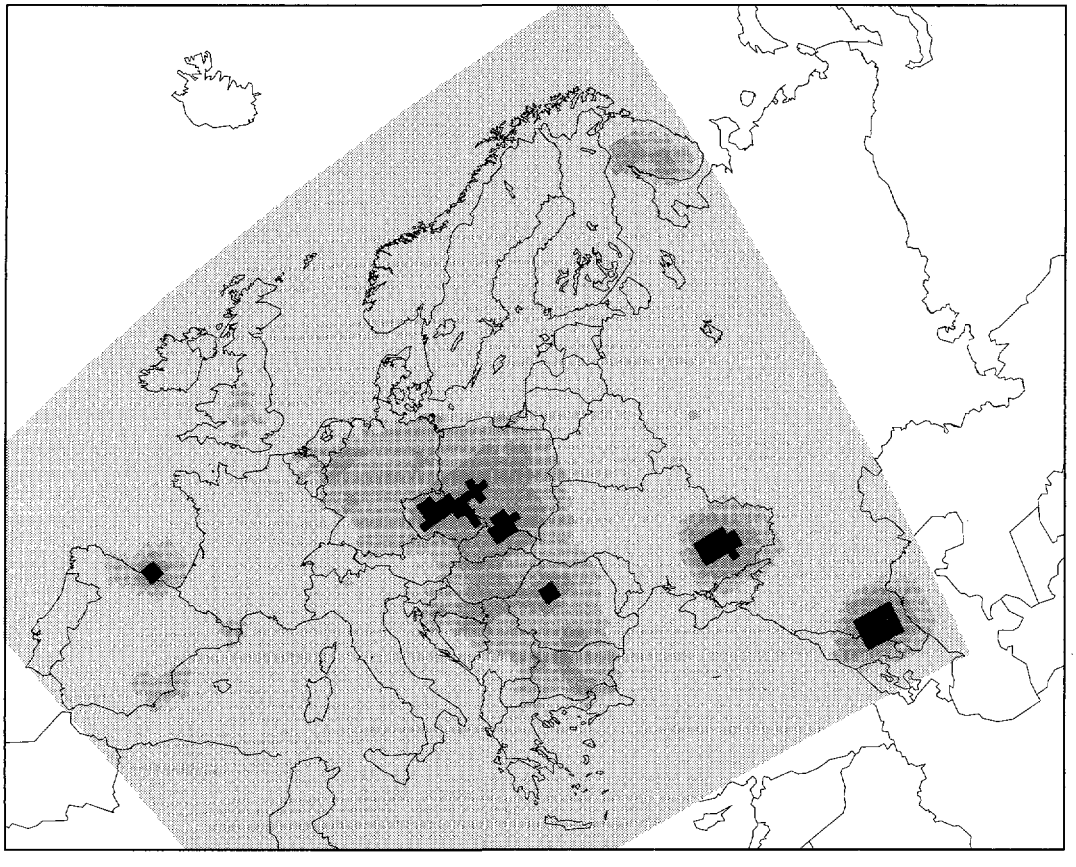
CENTRAL AND EASTERN EUROPE

TOTAL DEPOSITION OF CADMIUM

1990



GRAMS/ HA/YR

MAP 2

< 1
1 - 2
2 - 4
> 4

Computations: RIVM

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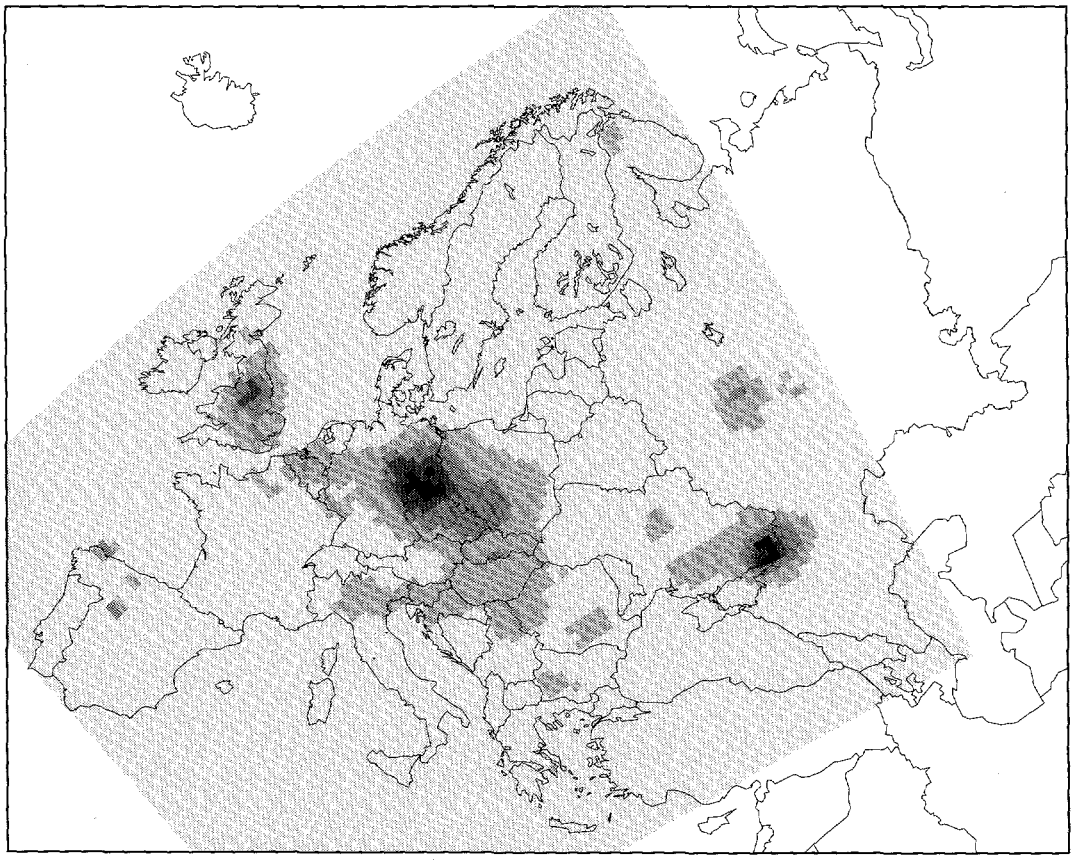
CENTRAL AND EASTERN EUROPE

CONCENTRATION OF SULFUR-DIOXIDE

AVERAGE CONCENTRATION IN 1990



MICROGRAM PER CUBIC METER

MAP 3

- < 10
- 10 - 20
- 20 - 40
- 40 - 60
- > 60

Computations: RIVM

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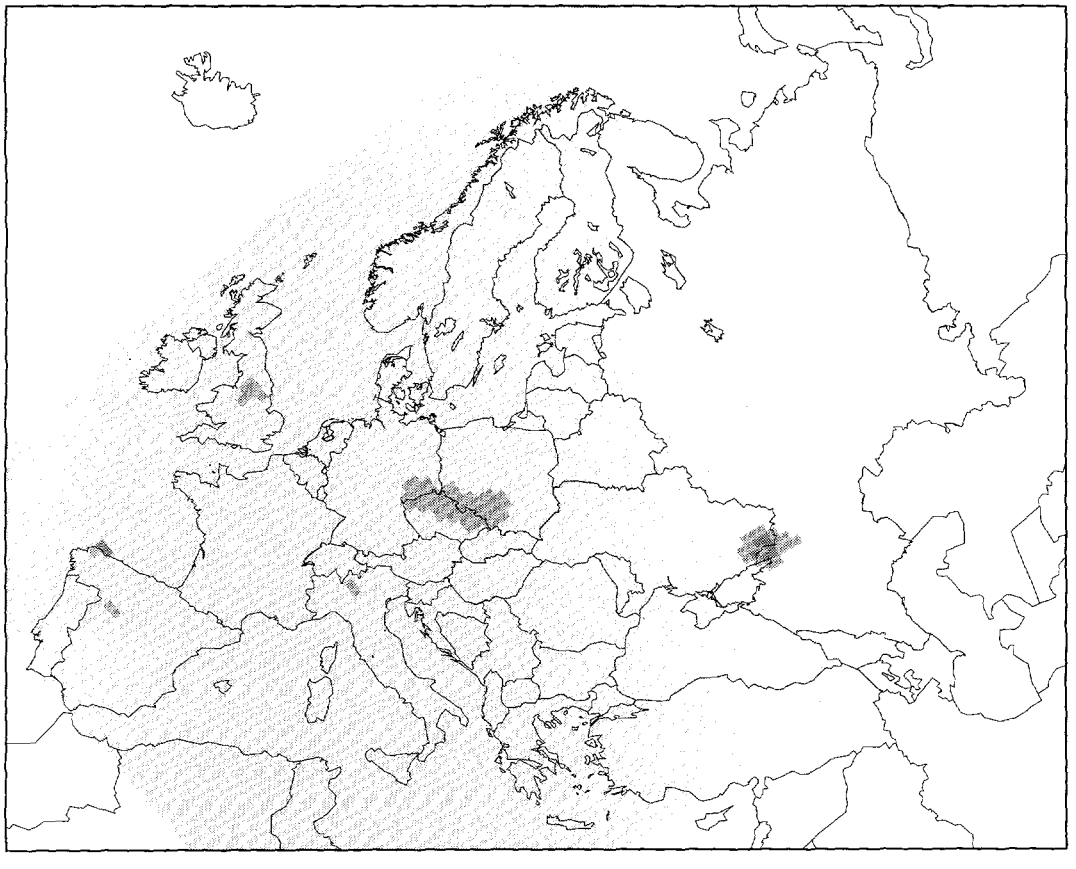
CENTRAL AND EASTERN EUROPE

CONCENTRATION OF SULFUR-DIOXIDE

AVERAGE CONCENTRATION IN 2010, SCENARIO 1



MICROGRAM PER CUBIC METER:

- < 10
- 10 - 20
- 20 - 40
- 40 - 60 (data class doesn't appear on map)
- > 60 (data class doesn't appear on map)

MAP 4

Scenario 1: Current Western energy efficiency and emission standards in new investments

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Computations: RIVM

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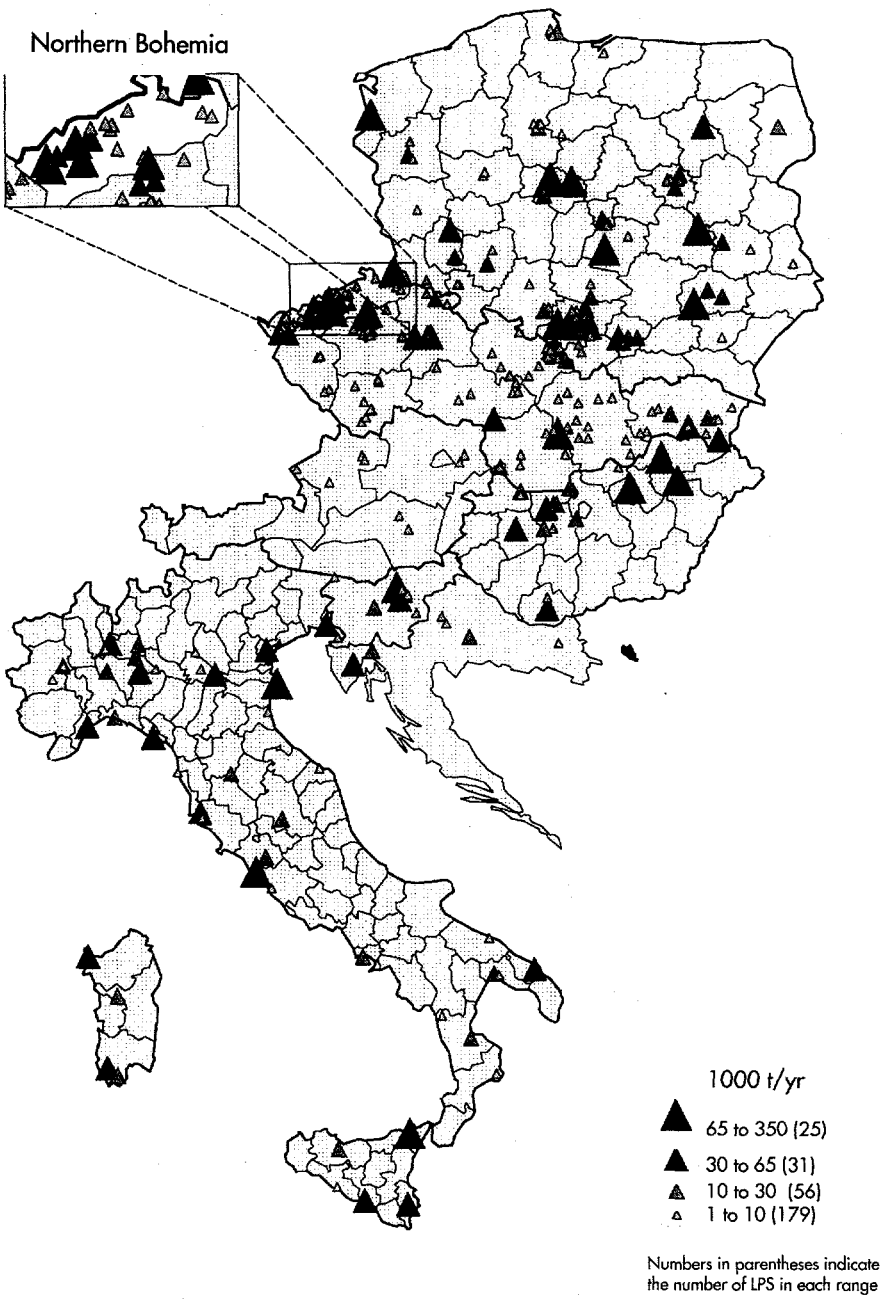
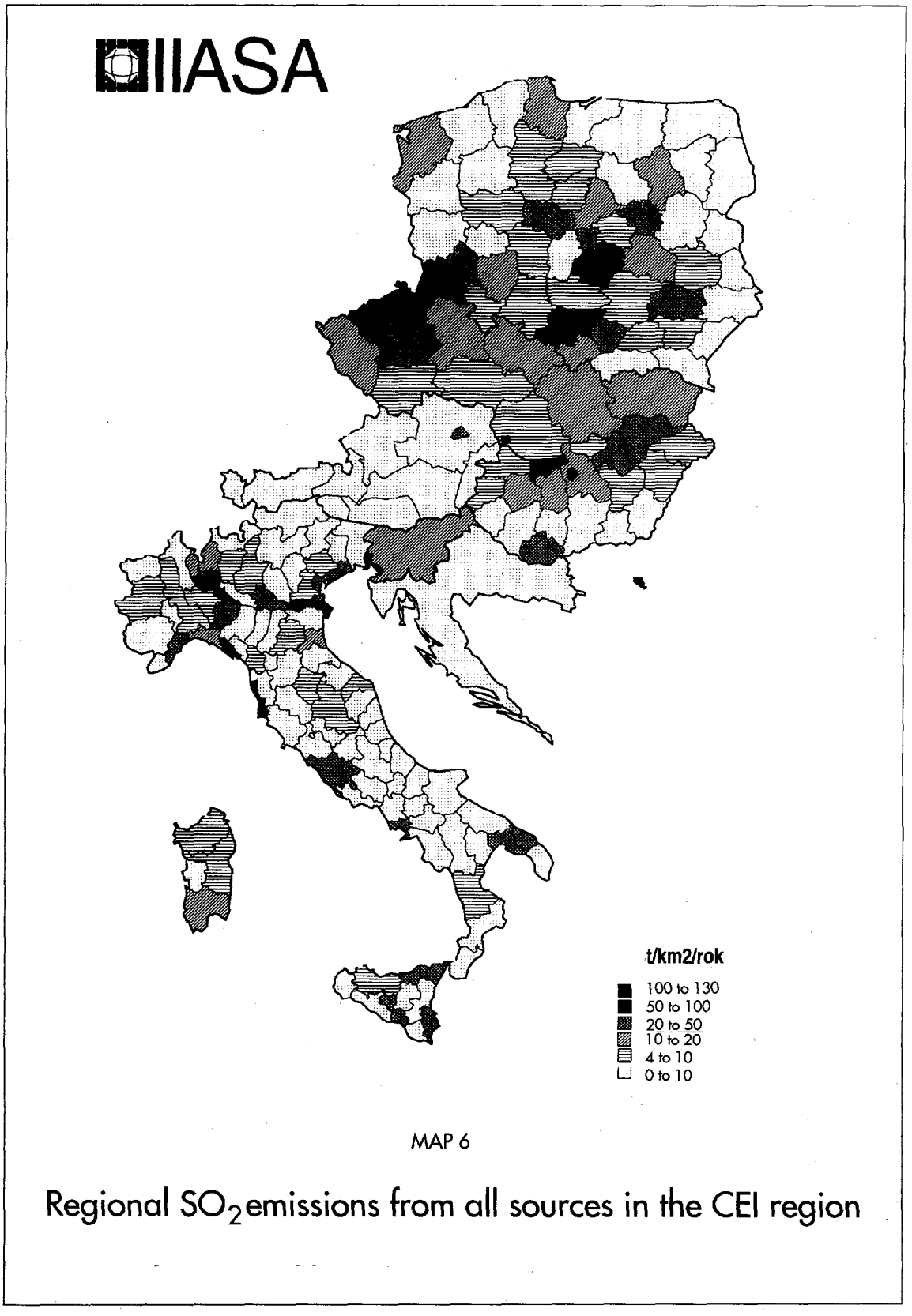


MAP 5

IIASA

Locations of large point sources of SO_2 emissions in the CEI region



MAP 6

Regional SO_2 emissions from all sources in the CEI region

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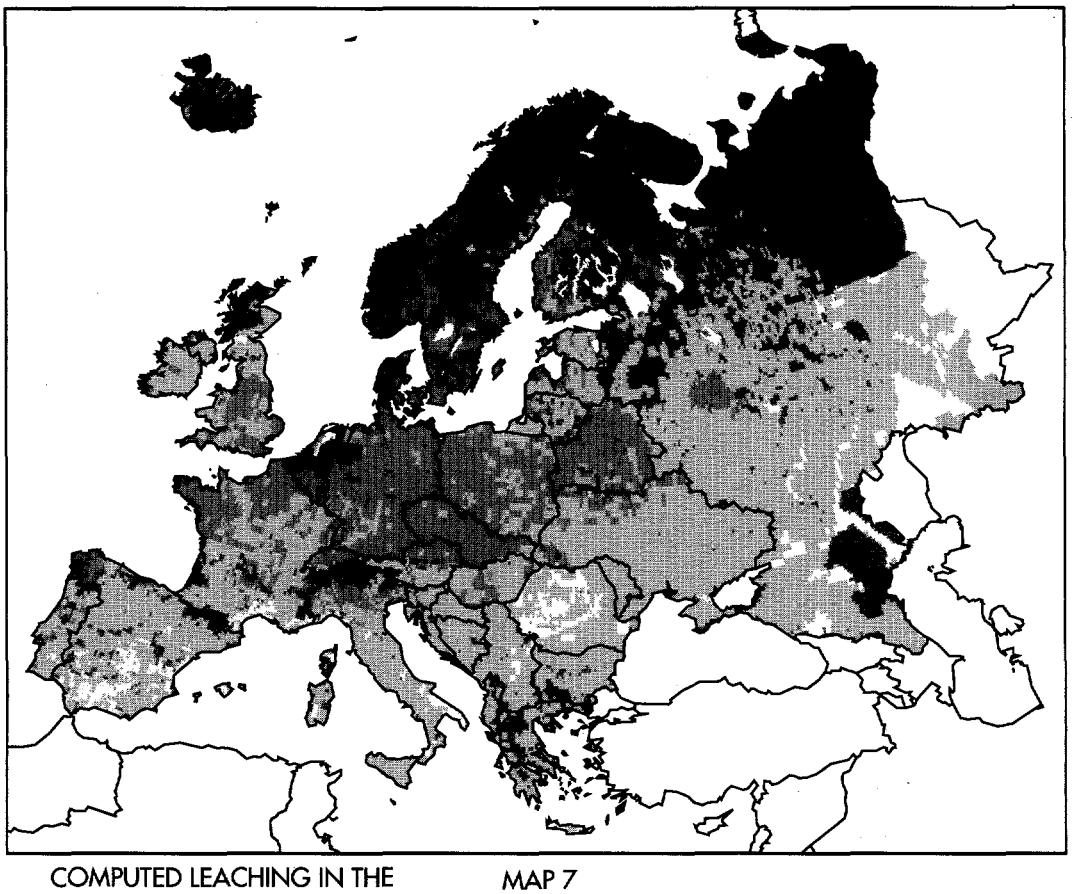
CENTRAL AND EASTERN EUROPE

LEACHING OF NITRATE IN AGRICULTURAL SOILS



COMPUTED LEACHING IN THE TOPSOIL IN MG/L

- No data
- 0 - 10
- 10 - 25
- 25 - 50
- 50 - 100
- > 100
- Mountainous regions, forest and natural areas

MAP 7

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Computations: RIVM

MARCH 1994

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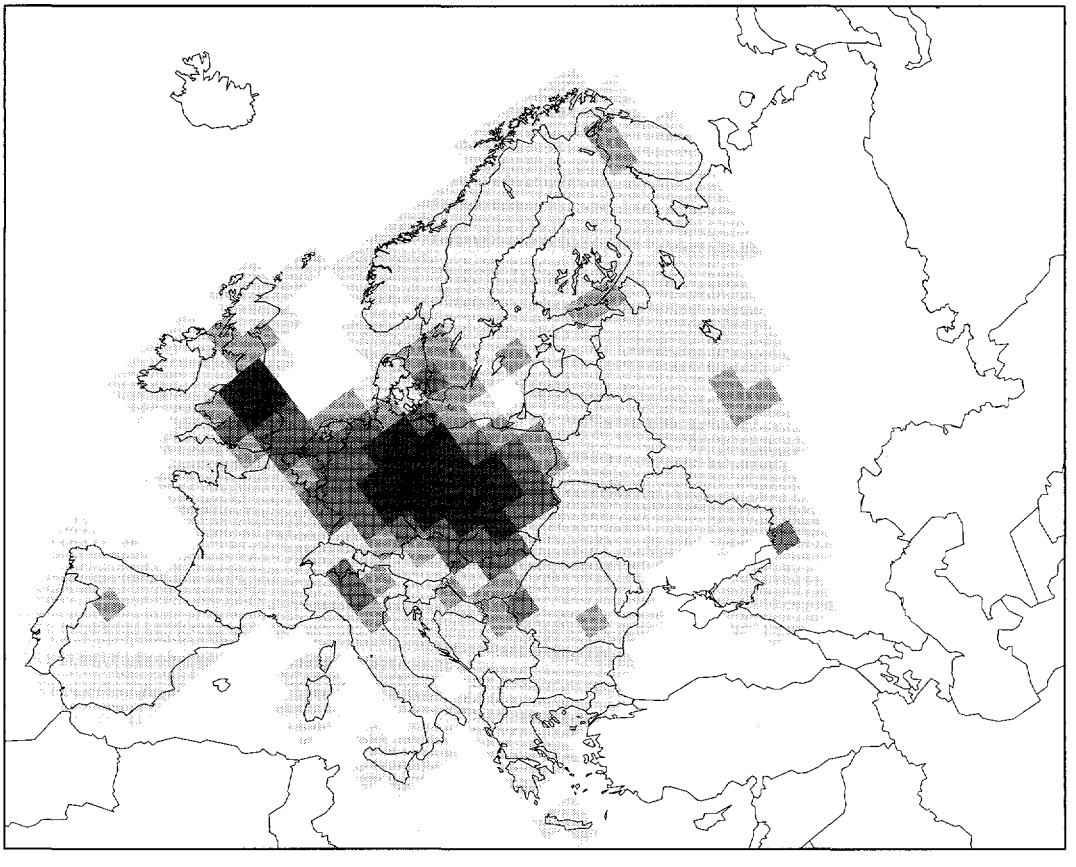
CENTRAL AND EASTERN EUROPE

EXCEEDANCE OF CRITICAL LOADS FOR ACIDITY
1990



EQ/HA/YR

- < 500
- 500 - 1000
- 1000 - 2000
- > 2000

MAP 8

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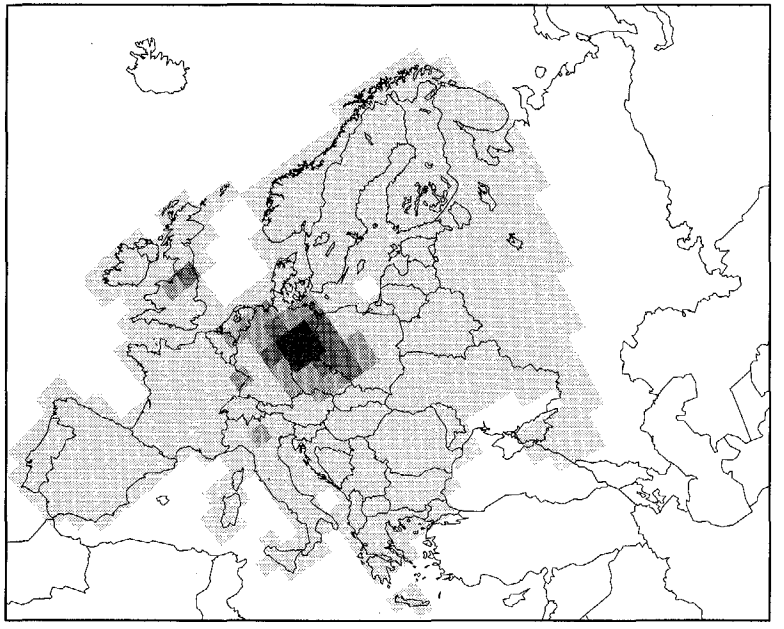
Computations: RIVM

MARCH 1994

IBRD 25301

CENTRAL AND EASTERN EUROPE

EXCEEDANCE OF CRITICAL LOADS FOR ACIDITY
2010, SCENARIO 1



MAP 9A

Scenario 1: Current Western energy efficiency and emission standards in new investments

EQ/HA/YR

- < 500
- 500 - 1000
- 1000 - 2000
- > 2000

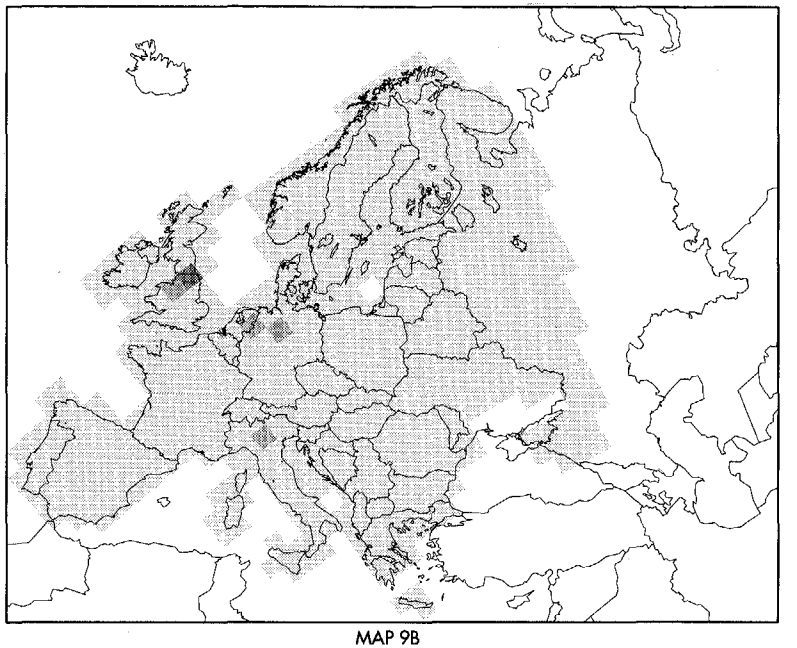
Computations: RIVM

JULY 1994

IBRD 25302

CENTRAL AND EASTERN EUROPE

EXCEEDANCE OF CRITICAL LOADS FOR ACIDITY
2010, SCENARIO 2



MAP 9B

Scenario 2: Current Western energy efficiency and emission standards applied to all equipment

EQ/HA/YR

- < 500
- 500 - 1000
- 1000 - 2000
- > 2000 (data class doesn't appear on map)

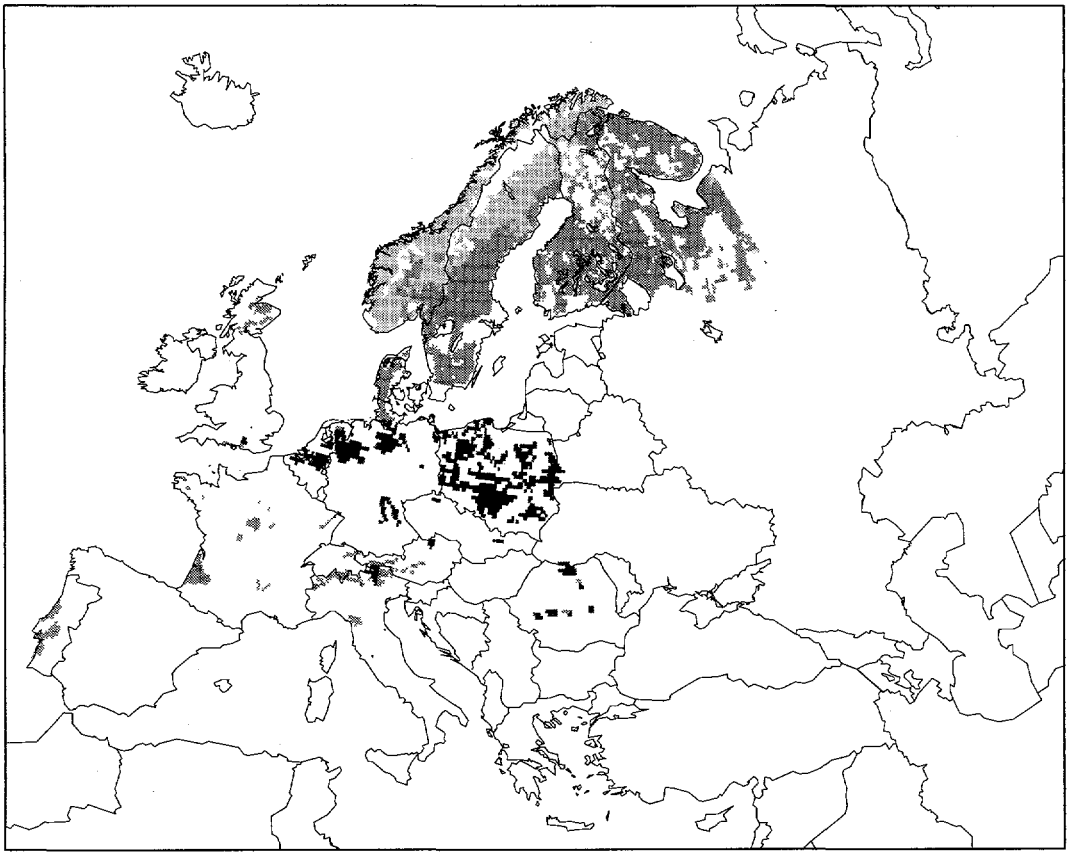
Computations: RIVM

JULY 1994

IBRD25304

CENTRAL AND EASTERN EUROPE

ALUMINUM CONCENTRATION IN ACIDIFIED SOILS



MAP 10

IN THE TOP METER OF GROUNDWATER IN MG/L

- < 0.2
- < 2.0
- < 5.0
- > 5.0

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Computations: RIVM

MARCH 1994

ABBREVIATIONS

ASP	Activated-Sludge Process
BACT	Best Available Control Technology
BAT	Best Available Technology
BATNEEC	Best Available Technology Not Entailing Excessive Cost
BOD	Biological Oxygen Demand
CAC	Command and Control
Cd	Cadmium
CEE	Central and Eastern Europe
CIS	Commonwealth of Independent States
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
COMECON	Council for Mutual Economic Aid
CPE	Centrally Planned Economy
CSFR	Czech and Slovak Federal Republic
DO	Dissolved Oxygen
EAP	Environmental Action Programme for Central and Eastern Europe
EBRD	European Bank for Reconstruction and Development
EU	European Union (formerly European Communities)
ECE	Economic Commission for Europe (U.N.)
ECU	European Currency Unit
EIB	European Investment Bank
ESP	Electro-Static Precipitator
FGD	Flue Gas Desulfurization
FSU	Former Soviet Union (also referred to as Newly Independent States)
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEMS	Global Environment Monitoring System (UNEP)
GHG	Greenhouse Gas
GNP	Gross National Product
IBRD	International Bank for Reconstruction and Development (World Bank)
IFI	International Financial Institution
IIASA	International Institute for Applied Systems Analysis (Laxenburg, Austria)
IMF	International Monetary Fund
IUCN	International Union for the Conservation of Nature and Natural Resources (now World Conservation Union)
LCP	Large Combustion Plant
LRMC	Long-Run Marginal Cost
LRTAP	Long-range Transboundary Air Pollution
MBI	Market-Based Instrument
N	Nitrogen
NGO	Non-Governmental Organization
NIS	Newly Independent States (Former Soviet Union)
NO_x	Nitrogen Oxide
NSPS	New Source Performance Standard(s)
O_3	Ozone
ODS	Ozone-Depleting Substance(s)
OECD	Organisation for Economic Co-operation and Development (Paris)
P	Phosphorus
Pb	Lead
PM	Particulate Matter (PM10 = Particulate Matter smaller than 10 μm)
SO_2	Sulfur Dioxide
Rb	Ruble (Russian Currency)
TN	Total Nitrogen (in water)
TP	Total Phosphorus (in water)
TSP	Total Suspended Particulates (in air)
TSS	Total Suspended Solids (in water)
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNECE	United Nations Economic Commission for Europe (ECE)
UNEP	United Nations Environment Programme
US$	United States Dollar(s)
VOC	Volatile Organic Compounds
WHO	World Health Organization

BASIC FIGURES FOR COUNTRIES IN CENTRAL AND EASTERN EUROPE [1]

	Area (000s sq km)	*Area relative to France*	*1992 Population (000s)*	*Population density per sq km*	*Percent urban*	*Cars* [2]	*Telephone lines* [3]	*Physicians* [4]	*Infant mortality* [5]
Albania	28.8	0.05	3,250	115	36	5	1.4	n.a.	32
Armenia	30.0	0.05	3,680	120	68	79	16.6	38	21
Azerbaijan	86.6	0.16	7,370	84	54	n.a.	9.5	40	32
Belarus	207.6	0.38	10,300	49	65	75	17.3	40	15
Bulgaria	110.9	0.20	8,500	77	69	171	27.2	31	16
Croatia	56.5	0.10	4,790	85	n.a.	135	20.1	n.a.	n.a.
Czech Republic	78.9	0.14	10,320	n.a.	n.a.	261	19.0	n.a.	10
Estonia	45.1	0.08	1,550	35	72	211	22.9	48	13
Georgia	69.7	0.13	5,470	79	56	n.a.	9.2	59	19
Hungary	93.0	0.16	10,310	111	66	187	14.6	29	16
Latvia	64.5	0.11	2,640	41	71	152	27.0	50	17
Lithuania	65.2	0.12	3,760	58	68	161	22.9	45	16
Moldova	33.7	0.06	4,360	130	47	51	12.0	40	23
Poland	312.7	0.57	38,370	122	63	176	11.5	20	14
Romania	238.0	0.43	22,750	97	53	79	11.5	18	23
Russia (European)	4,253.0	7.71	115,050	27	74	n.a.	15.6	48	20
Slovak Republic	49.0	0.09	5,300	n.a.	n.a.	n.a.	16.8	36	13
Slovenia	20.3	0.04	2,000	99	n.a.	320	25.9	n.a.	8
Ukraine	603.7	1.09	52,130	86	67	73	15.0	43	18
France	551.6	1.00	57,370	103	73	422	51.0	29	7
Netherlands	37.3	0.07	15,180	404	89	375	47.6	24	6

n.a. No statistics available.

1/ Refers to most recent year for which data are available. Figures for population, population density, percent urban are for 1992; car figures for Albania and Armenia are 1991, for Hungary 1992, for all others 1993; telephone lines for countries of Central and Eastern Europe 1993, for France and the Netherlands 1991; for physicians and infant mortality, 1990.

2/ Passenger cars per 1,000 inhabitants.

3/ Main telephone lines per 100 inhabitants.

4/ Physicians per 10,000 inhabitants.

5/ Number of deaths before age one per 1,000 live births.

6/ Figures for cars, telephones, physicians, and infant mortality are for Russia as a whole, not just European Russia.

Sources: Area, population, population density, and percent urban: World Bank. 1994. *Social Indicators of Development.*
Passenger cars, *International Road Federation. 1994. International Road Statistics 1989-1993;*
Telephone lines: International Telecommunications Union (ITU) and OECD. 1994. *Telecommunication Indicators for Economies in Transition;* ITU. 1992. *European Telecommunication Indicators.*
Physicians and infant mortality: World Bank. 1994. *World Development Report 1994*;

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