



# Protecting the Atmosphere

## AGENDA 21, CHAPTER 9

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**H**uman activities continue to damage the earth's atmosphere on several fronts. Locally, air pollution—primarily smog (ozone) and small particles from fuel combustion—threaten human health, particularly in urban areas. In rural areas, regional problems such as acid deposition (sulfates and nitrates) and atmospheric transport of nutrients and toxic materials harm crops and disturb the acid balance of lakes and estuaries. Globally, the stratospheric ozone layer continues to degrade, and carbon dioxide, methane, and other greenhouse gases are still rising, increasing the risk of significant climate change.

Fortunately, solutions to global atmospheric problems are often the very same measures needed to combat local and regional air pollution—not the focus here, but key problems nonetheless. On all these related fronts, the most important step that any nation can take is gradually relying more on renewable, non-polluting sources of energy—for power plants, industries, and transportation—and encouraging more efficient use of all energy sources.

### Climate Change

Greenhouse gases—principally carbon dioxide, but also methane, nitrous oxide, halocarbons, and other heat-trapping substances—threaten to alter climate throughout the world. Released in 1996, a new report from the Intergovernmental Panel on Climate Change (IPCC) provides the most recent global scientific assessment of the issue. The report concludes that:

- ❖ Global temperatures will rise between 1.5 °C and 4.0 °C if the atmospheric concentration of carbon dioxide doubles from its pre-industrial level of 280 parts per million by volume (ppmv) to 560 ppmv. (The current level is nearly 360 ppmv.)
- ❖ Global mean surface temperatures have already increased between 0.3° C and 0.6 °C, and global sea level has risen an average of 1.0 to 2.5 millimeters per year over the past century.
- ❖ Under conditions of moderate population growth and economic expansion—and absent any strong international effort to reduce carbon dioxide emissions—surface temperatures will increase 2.0°C over the next century, and sea level will rise 0.5 meters by 2100.

- ❖ It is unlikely that global temperature changes observed over the past century stem from natural causes alone.

Meanwhile, recent projections of global energy use over the next two decades foresee a marked increase in the amount of fossil fuel burning—with a concomitant increase in carbon-dioxide emissions. These projections—prepared by the International Energy Agency, the U.S. Department of Energy, and the World Energy Council—predict that in 2010, fossil fuels will supply about three quarters of the world's commercial energy. Without major international policies to curb their use, the amount of fossil fuels burned per year will be approximately 35 percent higher by 2010. As a result, energy-related carbon-dioxide emissions are expected to rise between 30 and 40 percent under moderate growth scenarios. Under one high-growth scenario, emissions would rise 93 percent by 2020.

These rising carbon-dioxide emissions run counter to the goals of the Framework Convention on Climate Change, one of two global conventions opened for signature at the 1992 United Nations Conference on Environment and Development (UNCED). To help stabilize atmospheric concentrations of greenhouse gases, the treaty committed industrialized nations to reduce greenhouse gas emissions to 1990 levels by 2000. It also gave them six months to devise national plans that included greenhouse gas inventories, projections, and reduction measures. While 150 nations signed the convention—which was viewed as just a first step toward mitigating climate change—only the United Kingdom and Germany have made significant progress toward meeting this goal.

In March 1995, parties to the convention met for the first time in Germany at the Berlin Climate Summit. Although they acknowledged current trends in greenhouse gas emissions—as well as the consequences of further inaction—participants did not enter into any new binding agreements to reduce emissions. But, in a decision called the Berlin Mandate, parties did agree that industrialized nations' current efforts to curb emissions were inadequate and that participants would strengthen the treaty at the third conference of parties in Japan in 1997.

## **Policy Opportunities:**

### **I. Respond strongly to the Berlin Mandate.**

To avoid the same lack of definitive action that followed the original convention, nations must negotiate an agreement on specific targets and timetables—short, medium, and long term—for reducing greenhouse gas emissions. If binding, such an agreement would give industries an incentive to begin using low- and non-carbon energy sources.

### **II. Accord special attention to the transportation sector.**

Recent studies have predicted that the number of four-wheel motor vehicles worldwide could grow from 580 million in 1990 to 816 million in 2010—the vast majority powered by fossil fuels. While most motor vehicles today are concentrated in the industrialized world, the greatest increases are expected in developing countries. If these nations follow transportation models set by the West—particularly the United States—traffic congestion and air pollution will intensify, and controlling carbon-dioxide emissions and the climate changes they are bringing about will be even harder.

To encourage development and greater use of public transportation, as well as more efficient use of fossil fuel-powered individual vehicles, governments should:

- ❖ raise fossil fuel prices to reflect the full cost of the air pollution, climate change, accidents, and other problems caused by motor vehicles;
- ❖ encourage changes in parking and tax policies to favor the use of public transportation;
- ❖ change toll prices so that drivers pay more during peak times of the day; and
- ❖ adopt land-use zoning reforms to encourage urban development that is more compatible with walking, bicycling, and public transportation.

Other potential solutions would come from developing and promoting motor vehicles that do less harm to the environment. Specifically, zero-emission vehicles—which currently consist of electric cars, trucks, and buses—could drastically cut air pollution and, depending on the electricity's source, produce only half as much carbon dioxide as comparable gasoline-powered alternatives do. If the electricity came from photovoltaic, wind, or other renewable sources, these emissions would fall to almost zero. To encourage greater use of electric vehicles, policy makers should reform fuel prices, as mentioned above, and

- ❖ share the cost of research and development with industry;
- ❖ support the development of appropriate new transportation infrastructure; and
- ❖ provide incentives and demonstration projects to stimulate the market for zero-emissions vehicles.

### **III. Use economic instruments to achieve emissions reductions.**

Taxes, tradable emissions permits, and other policies that make use of economic forces are often the most flexible and least costly way for nations to meet environmental goals. Among climate change experts, the idea of a carbon tax—taxing individuals and industries based on the size of their carbon-dioxide emissions—has been discussed for many years, and a few nations have actually taken steps toward implementing such measures.

As a powerful way to reduce carbon-dioxide emissions without major economic disruptions, carbon taxes work by creating economic incentives to use less carbon-intensive fuels

and products. Properly set, they encourage the cheapest reductions first and ensure that these reductions are achieved as cost effectively as possible. Comprehensive and flexible, carbon taxes allow the market to choose where and how reductions occur, spurring technological innovation in how energy is produced, supplied, and used.

To be effective, a carbon tax strategy must capture the potential economic and environmental benefits it offers without unduly hurting any single sector of the economy or group of consumers. Three general conditions are needed to meet this requirement:

1. the strategy must minimize short-term economic losses by very carefully using the revenues taxes provide;
2. it must maximize economic returns by lowering other tax rates; and
3. it must compensate groups adversely affected by the tax.

#### **IV. Focus attention on greenhouse gases other than carbon dioxide.**

Although carbon dioxide is the most important greenhouse gas driving changes in global climate, methane, and nitrous oxide (such compounds as HFCs, PFCs, and SF6) also play an important and, in some cases, increasing role. Because they are so stable—with atmospheric lifetimes of thousands of years—chemicals known as fully fluorinated compounds (FFCs) are particularly potent global warmers. They contribute less than 1 percent to today's greenhouse-gas effect on global climate, but their use has increased steadily in recent years, primarily in the aluminum, magnesium, semiconductor, electrical utility, and electronics industries. Particularly troubling, some industries are developing new uses for FFCs—in many cases, to replace ozone depleting chemicals that have been banned by international treaties.

To prevent this potentially serious problem from developing further, governments should:

- ❖ include FFCs in the greenhouse gas inventories required for the climate convention;
- ❖ coordinate their actions to abide by the climate and ozone treaties, making sure that policies to meet one do not compromise the goals of the other (an international process for evaluating the impact of CFC replacements on global warming would help in this process);
- ❖ include measures to control FFCs in national action plans drafted under the climate convention; and
- ❖ include FFCs in all climate convention protocols.

### **Ozone Depletion**

Scientific research has continued to strengthen the case that chlorofluorocarbons and other chemicals are destroying ozone in the earth's upper atmosphere (the stratosphere).

Stratospheric ozone protects living things from exposure to harmful levels of ultraviolet (UVB) radiation. High UVB levels can increase the risk of cancer, cataracts, and impaired immune function in humans and other animals and reduce crop yields, lower ocean productivity, and disrupt terrestrial ecosystems in ways that are still not fully understood. In addition to CFCs, the chemicals responsible for ozone destruction are halons, methyl bromide, methyl chloroform, hydrochlorofluorocarbons (HCFCs), and carbon tetrachloride, all of which contain bromine and chlorine.

Global monitoring has shown that stratospheric ozone has decreased for at least the last two decades and that the amount of UVB radiation reaching the Earth has increased. In the northern latitudes of Britain, Germany, and Scandinavia, the amount of UVB is increasing by nearly 7 percent per decade. Over southern latitudes (Argentina and Chile), UVB is increasing by 10 percent per decade.

In 1992 and 1993, global ozone levels reached record lows, partly because large amounts of sulfate particles were delivered to the stratosphere when Mount Pinatubo erupted in 1991. This natural event accelerated human-caused ozone depletion over the following two years. In 1996, the largest ozone hole ever measured formed over Antarctica, and in March 1996 a new record-low ozone measurement for the Northern Hemisphere was recorded in two locations in the United Kingdom. Meanwhile, researchers taking simultaneous measurements of total ozone and UVB levels in Antarctica and southern South America have strengthened the link between low ozone and high UVB radiation.

In 1985, the world's nations agreed to take strong action to stop depletion of stratospheric ozone by entering into the Vienna Convention for the Protection of the Ozone Layer, a treaty that was strengthened in 1987 by the Montreal Protocol on Substances that Deplete the Ozone Layer. This pact required industrialized governments to freeze halon use and halve CFC use by 1998. The protocol gave developing countries consuming less than 0.3 kilograms per capita of the chemicals an extra ten years to comply.

In 1990, 1992, and 1995, new scientific evidence convinced Montreal Protocol Parties to control additional ozone depleters and accelerate the phase-out: On January 1, 1996, all of the world's industrialized countries were to have ceased production of CFCs, carbon tetrachloride, and methyl chloroform (with a few essential uses exempted). These nations had already stopped producing halons in January 1994. Existing stocks can still be used, and limited production is allowed for export to developing countries.

In July 1996, the second conference of the parties (COP2) was held in Geneva. At this conference Tim Wirth, Under-Secretary of State for Global Affairs, gave full U.S. support to the recently released IPCC report on climate change. Wirth also announced that the United States would support binding targets to reduce greenhouse gas emissions.

On another positive note, measurements of several ozone depleters in the lower atmosphere (or troposphere) taken between 1991 and 1995 show a decline for the first time since such measurements have been taken. The findings suggest that the Montreal Protocol is indeed effective. But chlorine is expected to continue rising in the stratosphere for a few more years. For this reason, ozone depletion will worsen before it gets better, and full recovery of the ozone layer is not expected until well into the 21st century.

## **Policy Opportunities**

Although industrialized nations have made significant progress toward eliminating the use of many ozone-depleting chemicals, the production of methyl bromide (MB) and HCFCs remains a serious problem. Industrialized countries do not have to phase out MB until 2010, and developing countries have only agreed to freeze consumption in 2002. The phase-out of HCFCs has been extended until 2030 for industrialized countries and 2040 for developing nations. In addition, illegal trade in CFCs has become an issue in many regions of the world. The following policy actions could help to solve these remaining problems.

### **I. Strengthen the Montreal Protocol to require a rapid global phase-out of MB and HCFCs.**

Non-governmental environmental organizations have called on parties to accelerate the phase-out of Methyl Bromide and to delay any decisions on a "critical use" exemption.

### **II. Replenish the Montreal Protocol Multilateral Fund.**

Recognizing that developing countries require more time and some technical and financial assistance to meet the mandates of the Montreal Protocol, its Parties agreed to grant these nations a ten-year grace period and established a special fund, the Multilateral Fund for Implementation of the Montreal Protocol, to help developing countries switch to alternatives to ozone-depleting chemicals. Contributions to the fund come from industrialized nations. Although several nations were in arrears in 1995, at the meeting of the parties in Costa Rica in November 1996, it was agreed that the fund would be replenished with U.S.\$540 million over the next three years (1996-1999).

### **III. Develop safe alternatives to ozone-depleting substances still in use and low-cost technologies to safely destroy ozone-depleting chemicals.**

### **IV. Control illegal trade in CFCs by strictly enforcing the provisions of the Montreal Protocol.**

## V. Examples of Success

- ❖ The U.S. Customs Service, Environmental Protection Agency, Internal Revenue Service, Federal Bureau of Investigation, and Department of Justice (DOJ) have formed an anti-smuggling National CFC Enforcement Initiative. Operation Cool Breeze has handled 14 prosecutions and confiscated 1.2 million pounds of CFCs as of 1996. Illegal CFC imports into the United States are still a problem, but stepped-up enforcement efforts and high-profile indictments are helping to curb this traffic.
- ❖ Integrated Pest Management Systems (IPM)—the combination of crop rotation, pest monitoring, plant-based insecticides, and beneficial micro-organisms is enabling farmers in developed and developing countries to grow crops without using methyl bromide. Not only safer for the environment, IPM can save money too: tomato growers in Sicily save \$2000 per hectare by using IPM instead of methyl bromide. In Columbia, growers of fresh-cut flowers use IPM and sophisticated composting as an alternative to methyl bromide. A comparable methyl bromide-based system would cost Columbia growers 39 percent more.
- ❖ A campaign spearheaded by Greenpeace Germany has led to the refrigeration technology known as Greenfreeze by major German appliance manufacturers and has spread introduction of the technology to numerous countries. Greenfreeze uses hydrocarbons as the refrigerant and to make the insulation for refrigerator walls. The technology is ozone-safe and does not use HFCs. A project known as ECOFRIG involves Swiss, German, and Indian technical cooperation to apply hydrocarbon refrigerator technology in India. Two Indian companies—Godrej-GE and Boltas Ltd.—have pilot projects under way.
- ❖ Requirements to phase out CFCs motivated electronics firms to innovate and rethink how they manufacture electronic components. These creative firms together re-engineered the soldering process to avoid the need for a CFC cleaning solvent altogether. The development of “no clean technology”—soldering components in a controlled atmosphere—has allowed companies to phase out CFC use faster than expected and with cost-savings. Nortel, for example, estimates that it invested \$1million to purchase and employ new hardware and saved \$4 million in chemical waste-disposal costs and CFC purchases over a three-year phase-out.

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## **Other Sources of Information:**

### **World Wide Web:**

WRI Climate, Energy and Pollution site: "<http://www.wri.org/wri/cep/>"

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## **About WRI**

The World Resources Institute (WRI) is an independent center for policy research and technical assistance on global environmental and development issues. WRI's mission is to move human society to live in ways that protect Earth's environment and its capacity to provide for the needs and aspirations of current and future generations.

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