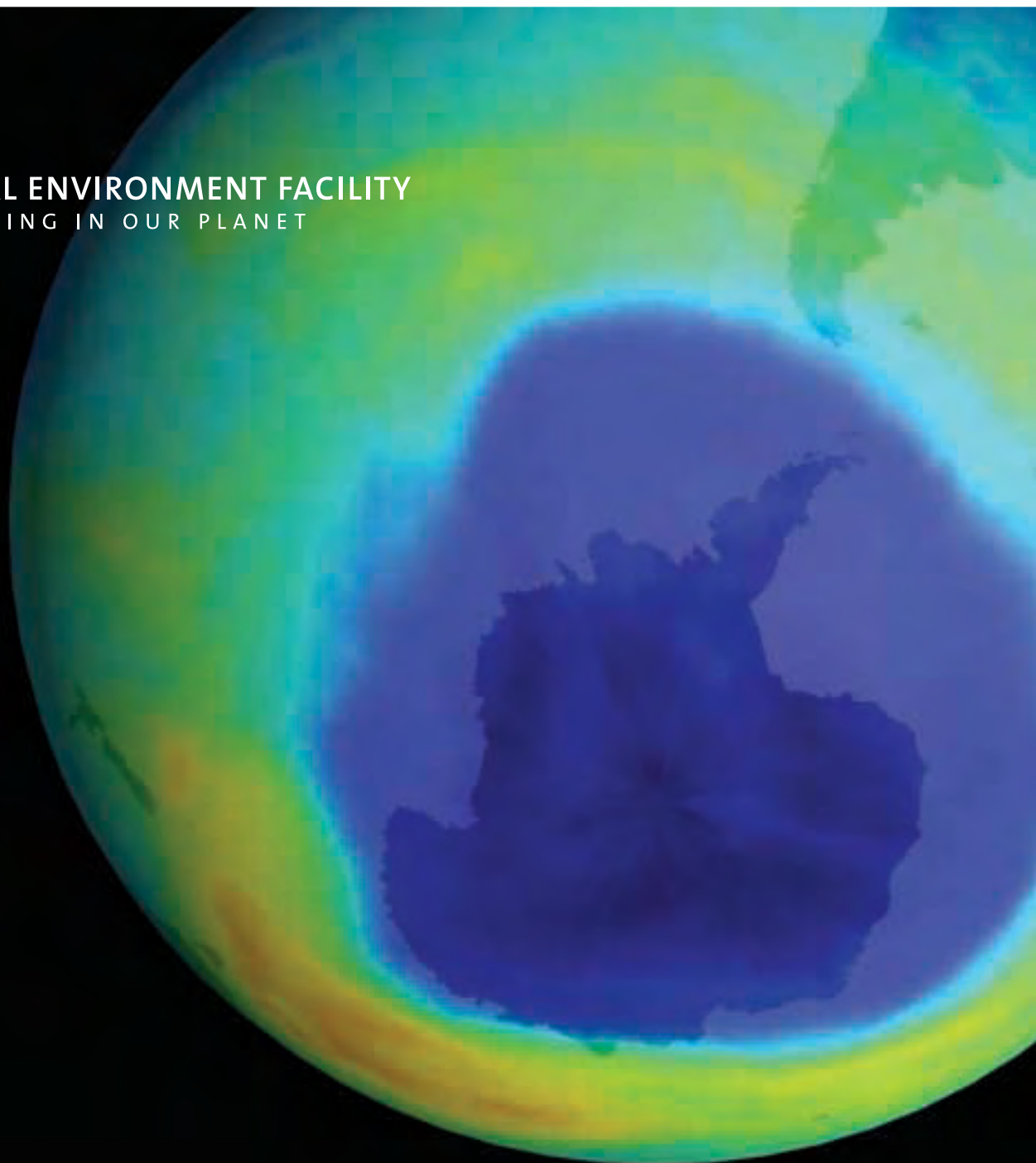




GLOBAL ENVIRONMENT FACILITY  
INVESTING IN OUR PLANET



INVESTING IN THE  
**phase-out**  
OF OZONE-DEPLETING SUBSTANCES  
THE GEF EXPERIENCE

A photograph of Earth from space, showing the horizon and clouds, with the sun rising or setting behind the horizon. The sun is a bright, glowing orb on the right side of the image, partially obscured by the Earth's horizon. The Earth's surface is covered in a dense layer of white clouds, and the blue of the oceans is visible between the cloud formations. The horizon line is a sharp, curved boundary separating the dark space of the sky from the bright, sunlit Earth.

# Foreword



**Monique Barbut**  
CEO and Chairperson  
Global Environment Facility

*Ozone depletion threatens human health, agriculture, biodiversity, and global climate. In 1987, the Montreal Protocol—one of the world's most successful multilateral environmental agreements—set aggressive timelines for countries to phase out the substances that were causing rapid ozone depletion in the Antarctic stratosphere.*

The Global Environment Facility (GEF), established in 1991, is the largest funder of projects to protect the global environment in developing countries and economies in transition (CEITs), and provides support for implementation of a number of Multilateral Environmental Agreements (MEAs), including the United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD), the Stockholm Convention on Persistent Organic Pollutants (POPs), and the United Nations Convention to Combat Desertification (UNCCD).

Complementing the work of the Multilateral Fund that supports developing countries under the Protocol, the GEF has addressed the issue of ozone depleting substances (ODS) to help CEITs meet Protocol targets by financing technology transfer, outreach and training, and programs to phase out ODS. Working with partners in both the public and private sectors, the GEF has approved up to US\$210 million, leveraging up to US\$250 million in co-financing for 28 ODS phase-out projects in 18 countries.

Among the GEF's most significant efforts to eliminate ODS are projects that transfer technologies to and strengthen institutional capabilities in CEITs. These projects have enabled the installation of non-ODS equipment and the adoption of practices by private sector businesses and industries, while providing CEITs with the legislative and policy frameworks that are necessary to sustain ODS phase-out.

Almost 25 years after its establishment, the Montreal Protocol has become a successful model for resolving global environmental challenges. GEF investments in CEITs have contributed to the success of the Protocol by phasing out 20,000 ozone depletion potential (ODP)-tonnes consumption and 29,000 ODP-tonnes production since 1987.

Global environmental issues overlap and converge; solutions to climate change, biodiversity, ozone depletion, and persistent organic pollutants can no longer be applied in separate silos of action. At the GEF, we are increasing our work across focal areas, drawing on synergies among technologies, sectors, and issues to deliver simultaneously multiple environmental benefits. For example, the GEF is leveraging resources from its chemicals and climate portfolios to support a catalytic project in Russia that aims to phase out ODS in refrigeration and air conditioning systems by substituting alternative technologies that are more energy efficient and avoid the use of alternative refrigerants which have adverse impacts upon the climate. Thus, the project achieves climate and ozone protection benefits. Similarly, other GEF projects promote the replacement of outdated appliances and equipment by more energy efficient systems which, at the same time, allow the shift to less ozone damaging refrigerants. The GEF is committed to supporting the phase-out of ODS as an integral part of sustaining our global environment.





# Actions

## TO PHASE OUT ODS

The environmental effects of ODS were first observed in the mid-1980s over the Antarctic stratosphere. Scientists, who had begun measuring ozone levels in 1975, estimated that ozone levels had declined by 60%–70% from their pre-1975 levels (GEF 2009a). Substances commonly found in refrigerants, foams, aerosol sprays, fire retardants, and pesticides were identified as the cause of the depletion, which was allowing increased amounts of dangerous ultraviolet-B (UV-B) radiation to reach the earth. This discovery prompted inter-governmental action to reduce ozone-depleting substances (ODS).

## Ozone-Depleting Substances

ODS are stable, organic compounds that include chlorofluorocarbons (CFCs), hydro-chlorofluorocarbons (HCFCs), and methyl bromide (see Table 1). Commonly found in everyday products such as air conditioners, refrigerators, deodorants, hair sprays, fire extinguishers, and pesticides, ODS released into the atmosphere react with the ozone layer and break it down. The resulting ozone depletion allows increased UV-B radiation to reach the earth, which can increase incidences of skin cancer, immune system suppression, crop damage, and diminished biodiversity on a global scale. In addition, ODS are powerful greenhouse gases (IPCC 2007).



WHAT IS

# OZONE?

Ozone ( $O_3$ ) is the chemical substance that absorbs 93%–99% of harmful UV rays from the sun, making life on earth possible. The ozone layer is located in the lower stratosphere of the earth's atmosphere, approximately 10km to 50km above the surface of the earth.

**TABLE 1 OZONE-DEPLETING SUBSTANCES**

ODS are stable, organic compounds that enable free radical catalysts like chlorine, fluorine, and bromine to enter the stratosphere without being destroyed in the troposphere. Below are some examples of common ODS.

| Compound                  | Symbol                           | Typical uses  | Ozone Depletion Potentials <sup>1</sup> | Global Warming Potentials <sup>2</sup> |
|---------------------------|----------------------------------|---|---|--|
| Chlorofluoro-carbons      | CFCs                             | Commonly used in refrigeration, air conditioning, aerosol spray propellants, solvents, and foam-blowing agents, CFCs were first developed in the 1930s and gained wide application following World War II due to their non-toxic and non-flammable properties. They have a relatively long atmospheric lifetime of 45–100 years, so the chlorine from one CFC molecule can do significant damage to the ozone layer (Fahey 2006). | 0.6–1                                   | 4,750–14,400                           |
| Hydrochloro-fluorocarbons | HCFCs                            | Like CFCs, HCFCs are commonly used for refrigerants, aerosol propellants, foam manufacture, and air conditioning. They are used as a transitional substance from CFCs to ODS alternatives.  | 0–0.2                                   | 124–14,800                             |
| Methyl Bromide            | CH <sub>3</sub> Br               | Methyl bromide is a toxic chemical that is commonly used to remove insects, rodents, weeds, and fungi from agricultural fields, grain elevators, mills, ships, clothes, and greenhouses.  | 0.6                                     | 5                                      |
| Halons                    |                                  | Halons are compounds most commonly used in fire extinguishers.  | 3–10                                    | 1,640–7,140                            |
| Carbon Tetrachloride      | CCl <sub>4</sub>                 | Carbon tetrachloride is used as a raw material for the production of chemicals, including other ODS. It was widely used as a cleaning agent, in fire extinguishers, and even as a pesticide.  | 1.1                                     | 1,400                                  |
| Methyl Chloroform         | CH <sub>3</sub> CCl <sub>3</sub> | Methyl chloroform is used as a solvent and degreasing agent. It is also an ingredient in consumer products such as household cleaners, paints, glues, and aerosol sprays.   | 0.1                                     | 146                                    |

1. Relative amount of degradation to the ozone layer the compound can cause, with trichlorofluoromethane (R-11 or CFC-11) being fixed at an ODP of 1.0 (EPA 2010b).

2. 100 year global warming potentials relative to CO<sub>2</sub> (GWP of CO<sub>2</sub> = 1) (IPCC 2007)



## The Montreal Protocol and Amendments

To address the problem of ozone depletion, governments from around the world convened at the 1985 Vienna Conference. They agreed on the Vienna Convention for the Protection of the Ozone Layer, a multilateral environmental agreement that provides a framework for international efforts to protect the ozone. While this agreement signified an important step forward, there remained a critical need for countries to commit to reducing ODS. As a result, the Montreal Protocol on Substances That Deplete the Ozone Layer was developed and opened for signature in 1987. This international agreement aims to phase out ODS by setting binding reduction goals. To date, the Protocol has been signed by 191 countries. Key components include the following:

- Phase-out of ODS according to prescribed timetables for developing (Article 5) and developed (Non-Article 5) countries
- A ban on ODS trade with non-signatory Parties and controls on ODS trade among Parties
- Creation of the Multilateral Fund—the financial mechanism of the Montreal Protocol that aids Article 5 countries with Protocol compliance
- A requirement for Parties who produce and consume ODS to provide a baseline and subsequent annual reports, and to conduct research, development, and information-sharing efforts on ODS substitutes

The Protocol originally required developed countries to begin phasing out CFCs in 1993 and to reduce total ODS consumption to half of 1986 levels by 1998 (EPA 2010a). Four Protocol Amendments and one Adjustment have since been put in place to strengthen the original requirements by stipulating accelerated timetables and accounting for new ODS:

- The London Amendment (1990) required developed countries to eliminate CFCs, halons, and carbon tetrachloride by the year 2000 and required developing countries to eliminate these ODS by 2010. Methyl

### MONTREAL PROTOCOL PARTY CLASSIFICATION

#### ARTICLE 5 PARTIES ARE

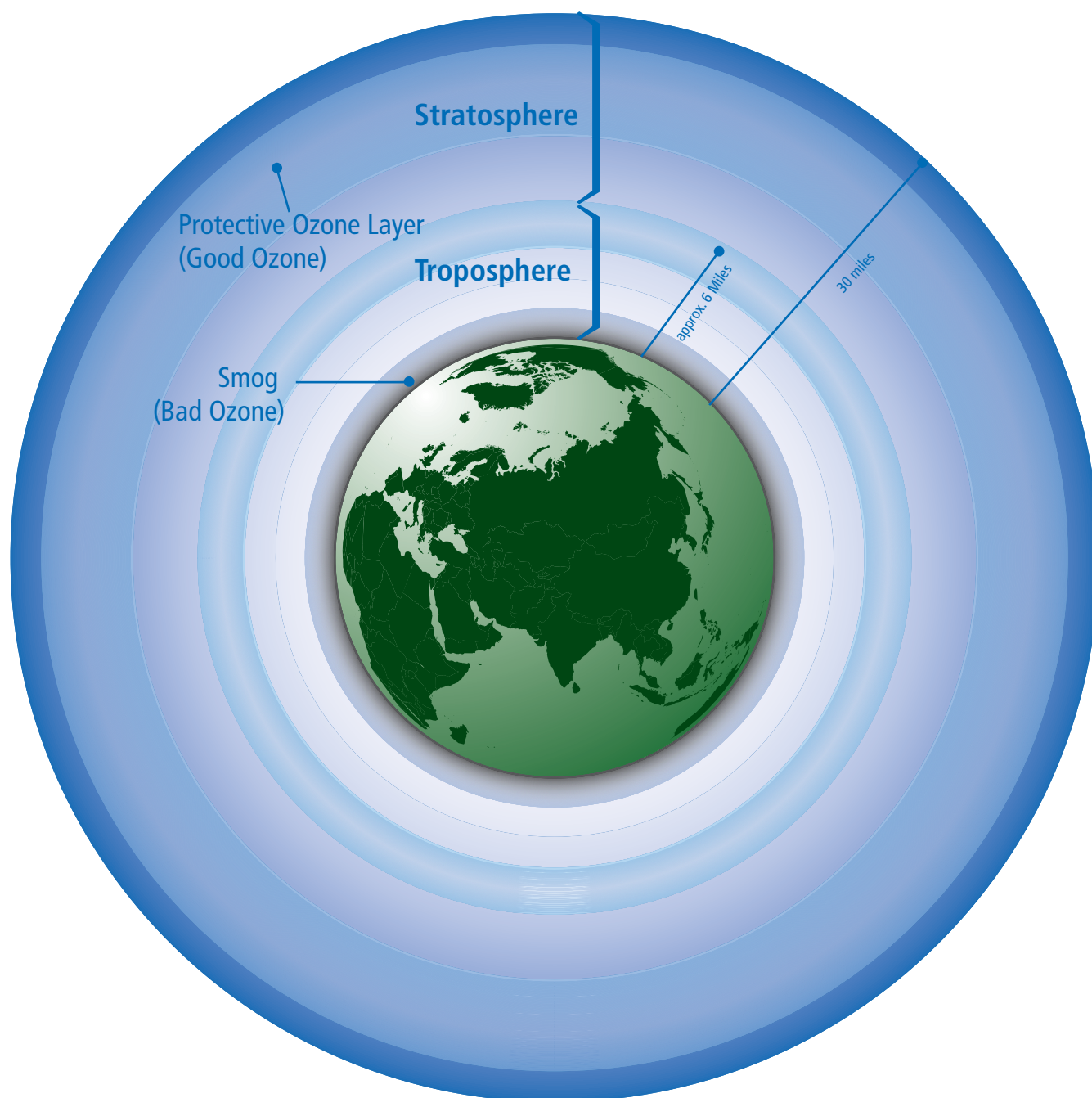
developing countries that are eligible for Multilateral Fund funding.

#### NON-ARTICLE 5 PARTIES ARE

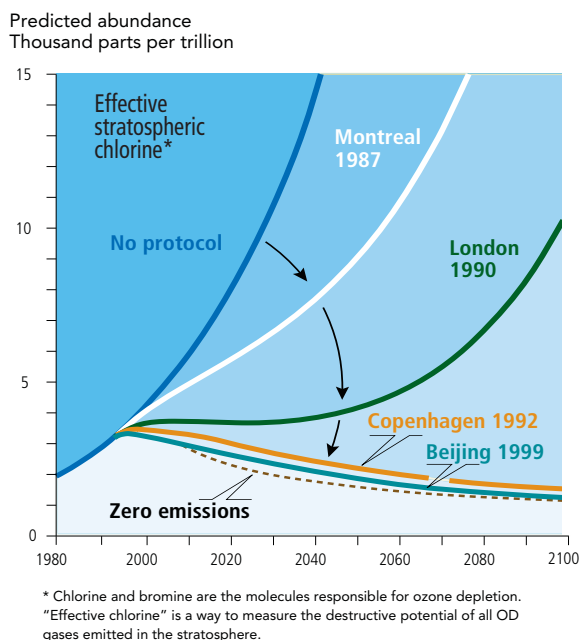
developed countries that are required to follow a more aggressive timeline for ODS phase out.

chloroform has since been added to the list of ODS for elimination in developed and developing countries by 2005 and 2015, respectively (EPA 2010a).

- The Copenhagen Amendment (1992) required CFCs, halons, carbon tetrachloride, and methyl chloroform be completely phased out in developed countries by 1996. HCFCs were also scheduled to begin phase-out in developed countries in 2004 (EPA 2010a).
- The Montreal Amendment (1997) produced a phase-out schedule for HCFCs in developing countries, and targeted the complete phase-out of methyl bromide for developed countries by 2005 and developing countries by 2015 (EPA 2010a).
- The Beijing Amendment (1999) increased restrictions on HCFC production and trade, and scheduled complete phase-out of methyl bromide for developed countries by 2004 (EPA 2010a).
- The Montreal Adjustment on Production and Consumption of HCFCs (2007) included commitments to accelerate the freeze year and the phase-out of HCFCs in developed and developing countries. For example, non-Article 5 parties agreed to increase the cap on HCFCs from a 65 percent reduction in 2010 to a 75 percent reduction by 2010 and Article 5 parties agreed to freeze HCFCs by 2013, rather than by 2016, among other adjustments.

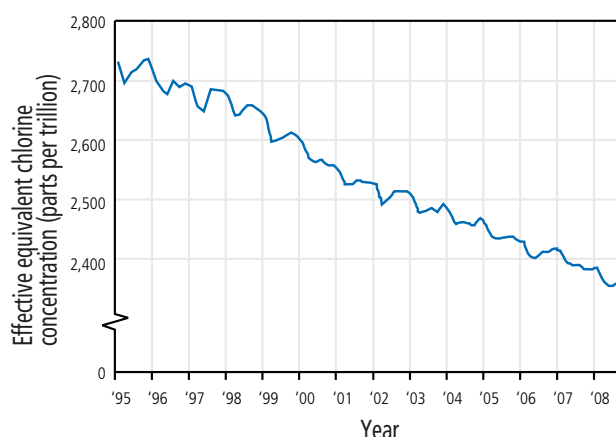


**FIGURE 1 EFFECTS OF THE MONTREAL PROTOCOL AMENDMENTS**



Source: Fahey 2006.

**FIGURE 2 GLOBAL EFFECTIVE EQUIVALENT CHLORINE CONCENTRATIONS**



Source: EPA 2010c

## Reversing Ozone Depletion

Due in part to the Montreal Protocol, its amendments and adjustments, and the work done to achieve ODS reductions to date, global and annual production and consumption of ODS decreased by 95% from 1989 to 2005 (CCSP 2008). As a result, total levels of ODS and ODS substitutes released into the atmosphere, including hydrofluorocarbons (HFCs), also decreased during this period, declining by 81%.<sup>1</sup>

The concentration of ozone-depleting substances in the atmosphere has begun to decrease since the enactment of the Protocol. Effective equivalent troposphere chlorine (EETC), a common measure of the concentration of ozone-depleting substances in the atmosphere, has decreased by 14% from a peak of 2,700 parts per trillion in the mid-1990s (see Figure 2). A significant reduction in atmospheric concentrations of the following ODS have also been found:

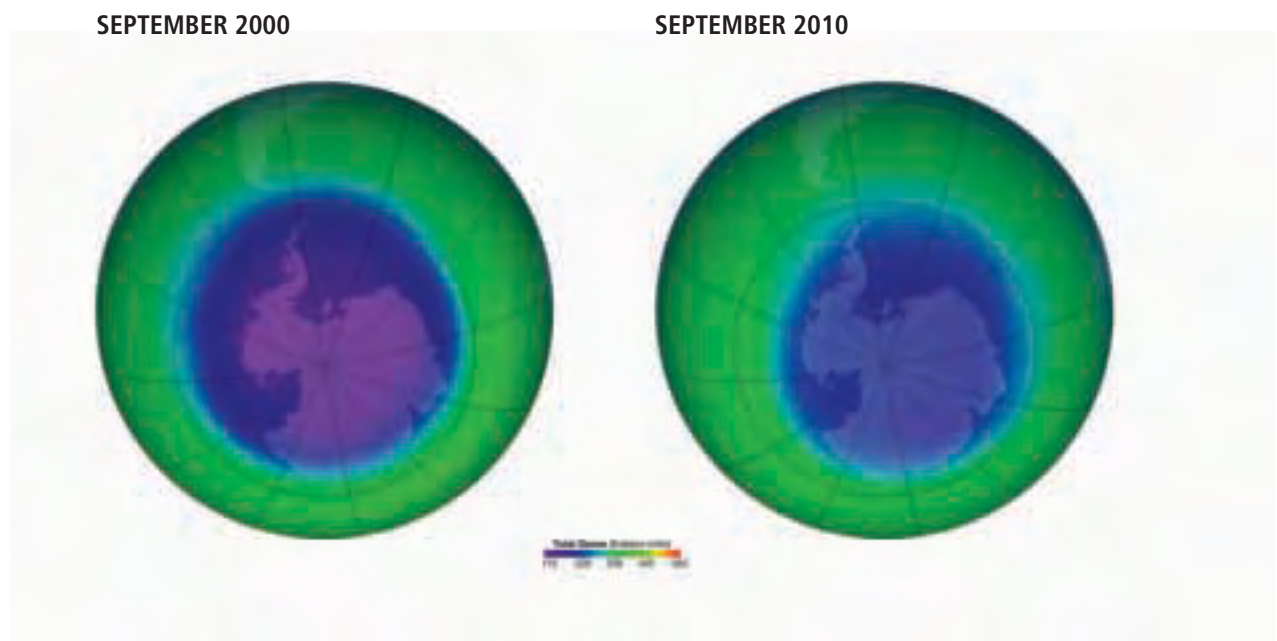
- 93% reduction in methyl chloroform
- 6% reduction in CFCs
- 24% reduction in methyl bromide

The work that has been done to date has helped to begin the reversal of stratospheric ozone depletion (see Figure 3). However, there is still work to be done. Due to longer atmospheric lifetimes, halon and HCFCs have not stabilized in the atmosphere yet. As a result, atmospheric concentrations of these ODS are still increasing. In addition, CFC emissions have failed to decrease as significantly as other ODS because of continued use in developing countries and emissions from stockpiles in developed countries (EPA 2008).

Compounding these issues, many countries with economies in transition (CEITs) in Central and Eastern Europe, Russia, and the republics of the former Soviet Union continue to have difficulty meeting phase-out targets. When the Montreal Protocol was approved in 1987, these countries were not classified as Article 5 countries, requiring them to meet aggressive ODS phase-out targets and making them ineligible for financing under the Multilateral Fund.

1. When emissions are weighted with factors relevant to ozone depletion

FIGURE 3 ANTARCTIC OZONE HOLE



However, the dissolution of the USSR in 1990–1991 forced them into a period of economic and political transition, justifying the global community’s support to meet their obligations under the Protocol.

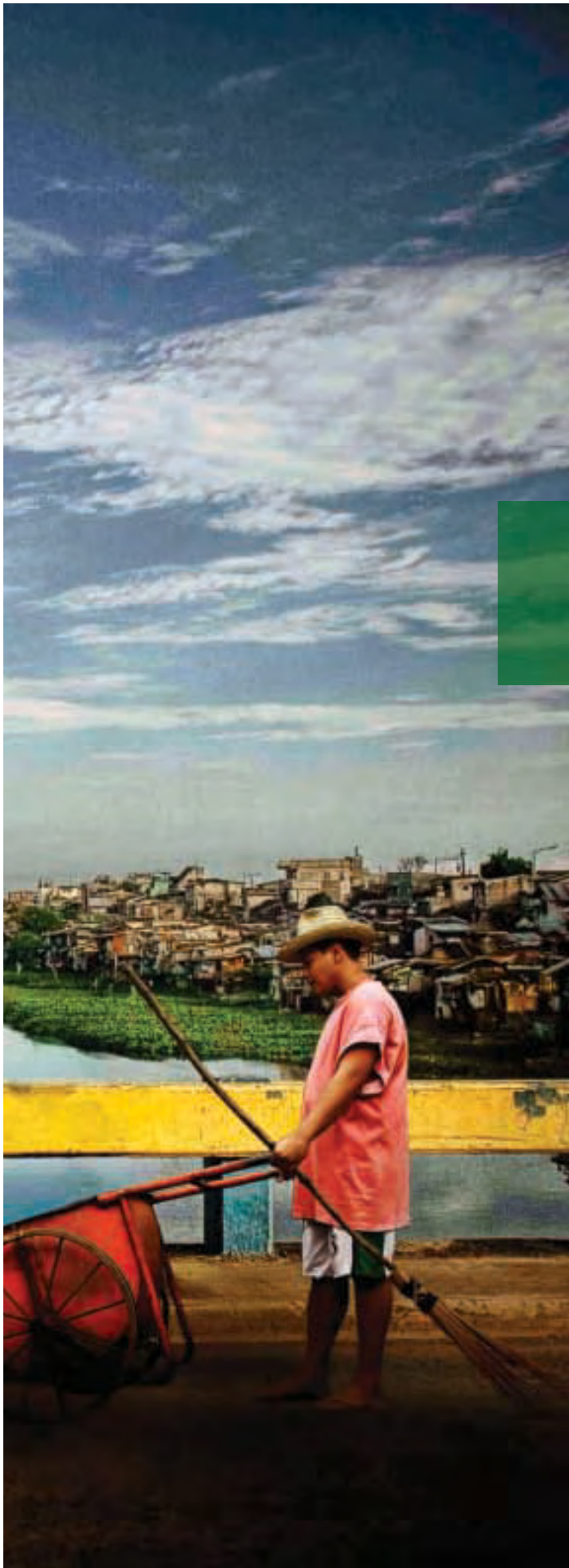
Since 1991, the GEF has assisted 18 non-Article 5 CEITs in efforts to meet the ODS phase-out targets of the Montreal Protocol. The GEF has supported 30 projects that have transferred new technologies, enhanced recycling operations, and provided training to reduce ODS use in these countries.

To date, the GEF has facilitated a large drop in the consumption and production of CFCs, but work still needs to be done to address other ODS, such as HCFCs. The GEF remains committed to assisting eligible recipient countries in meeting the ODS phase-out targets set by the international community under the Protocol.

20 GEF-SUPPORTED CEITS - 1991-2010

|                |                    |              |
|----------------|--------------------|--------------|
| Armenia        | Kazakhstan         | Slovenia     |
| Azerbaijan     | Latvia             | Tajikistan   |
| Belarus        | Lithuania          | Turkmenistan |
| Bulgaria       | Poland             | Ukraine      |
| Czech Republic | Russian Federation | Uzbekistan   |
| Estonia        |                    |              |
| Hungary        | Slovakia           |              |





# GEF ODS

## PROJECT PORTFOLIO

Over the past 19 years, the GEF has approved up to US\$210 million with \$250 million in co-financing from government, private sector organizations, and other stakeholders through four funding replenishment cycles (see Table 2). This level of resources has aided 18 CEITs in meeting ODS phase-out targets through support for 28 projects (GEF 2009a).

The GEF portfolio of ODS phase-out projects includes a range of activities that aim to phase out the greatest amount of ODS at the lowest cost on a country or regional level. These activities include building institutional strength, implementing training activities, conducting education and outreach, improving enterprise sustainability, and supporting recovery, recycling, and reclamation (3R) of ODS. The goal is to enable CEITs to comply with the Protocol and adopt new environmentally sound technologies, tools, and techniques that can aid the growth of their industries.

The GEF uses replenishment cycle funding to provide support to ODS phase-out projects via implementing agencies, in the form of investment grants, partial loan guarantees, and special-purpose funds. These agencies include the World Bank, the United Nations Development Program (UNDP), the United Nations Environment Programme (UNEP), and the United Nations Industrial

**TABLE 2 LEVEL OF APPROVED FINANCING IN ODS PHASE-OUT**

| Cycle                | GEF Funding<br>(US\$ Millions) | Type of Project(s)   |
|----------------------|--------------------------------|--|
| Pilot<br>(1991–1994) | 4.2                            | Regional monitoring and research projects in the Czech Republic  |
| GEF-1<br>(1995–1998) | 120.7                          | Recovery, recycling, and reclamation (3R) operations, technology transfer, institutional strengthening, and training projects across Eastern Europe and Russia |
| GEF-2<br>(1998–2002) | 44.6                           | 3R, technology transfer, institutional strengthening, and training projects in the Baltic, Caucasus, and Central Asian regions                                 |
| GEF-3<br>(2002–2006) | 12.0                           | Support for the phase-out of methyl bromide in Bulgaria, the Czech Republic, Hungary, Latvia, Lithuania, Poland, and Slovakia                                  |
| GEF-4<br>(2006–2010) | 28.5                           | Support for the phase-out of HCFCs in regional projects and a multi-focal area project in the Russian Federation   |
| <b>TOTAL</b>         | <b>210.0</b>                   |  |

Development Organization (UNIDO). Once projects are established, National Ozone Units (NOUs) in each country help to facilitate coordination between implementing agencies, government, and private sector stakeholders and track the progress of ODS phase-out during the course of the project.

To date, the range of projects in the GEF's portfolio have targeted the phase-out of many of the ODS that are outlined in the Montreal Protocol. Within these ODS areas, the GEF has supported the following activities:

- **CFCs**—To mitigate the effects of CFCs, the GEF has invested in the conversion of manufacturing plants, as well as technology transfer projects in three areas: retrofitting ODS equipment and installing new ODS-free equipment, implementing 3R operations, and training technicians on proper 3R procedures.

- **HCFCs**—GEF efforts to phase out HCFCs include strengthening institutional capacity to address phase-out targets, installing ODS alternative technologies, and developing ODS collection and destruction methods.

- **Methyl Bromide**—To phase out methyl bromide, the GEF has supported activities that provide financial and technical assistance to purchase and install methyl bromide alternative technologies, as well as activities that train farmers and postharvest specialists on these alternatives.

- **Halons**—To phase out halons in CEITs, the GEF has focused primarily on three activities: replacing halons with alternatives, developing halon banks, and training technicians for halon recovery.

The success of the GEF's efforts to help CEITs meet the Protocol's phase-out targets is evident in the reduced

## IMPLEMENTING AGENCIES:

# GEF-1 THROUGH GEF-4



**WORLD BANK**—Addressed refrigeration, aerosols, and foams in the emerging private sector of Eastern Europe and the Russian Federation.



**UNDP**—Designed and implemented investment projects with the private sector in the smaller economies of the region, in partnership with UNEP.



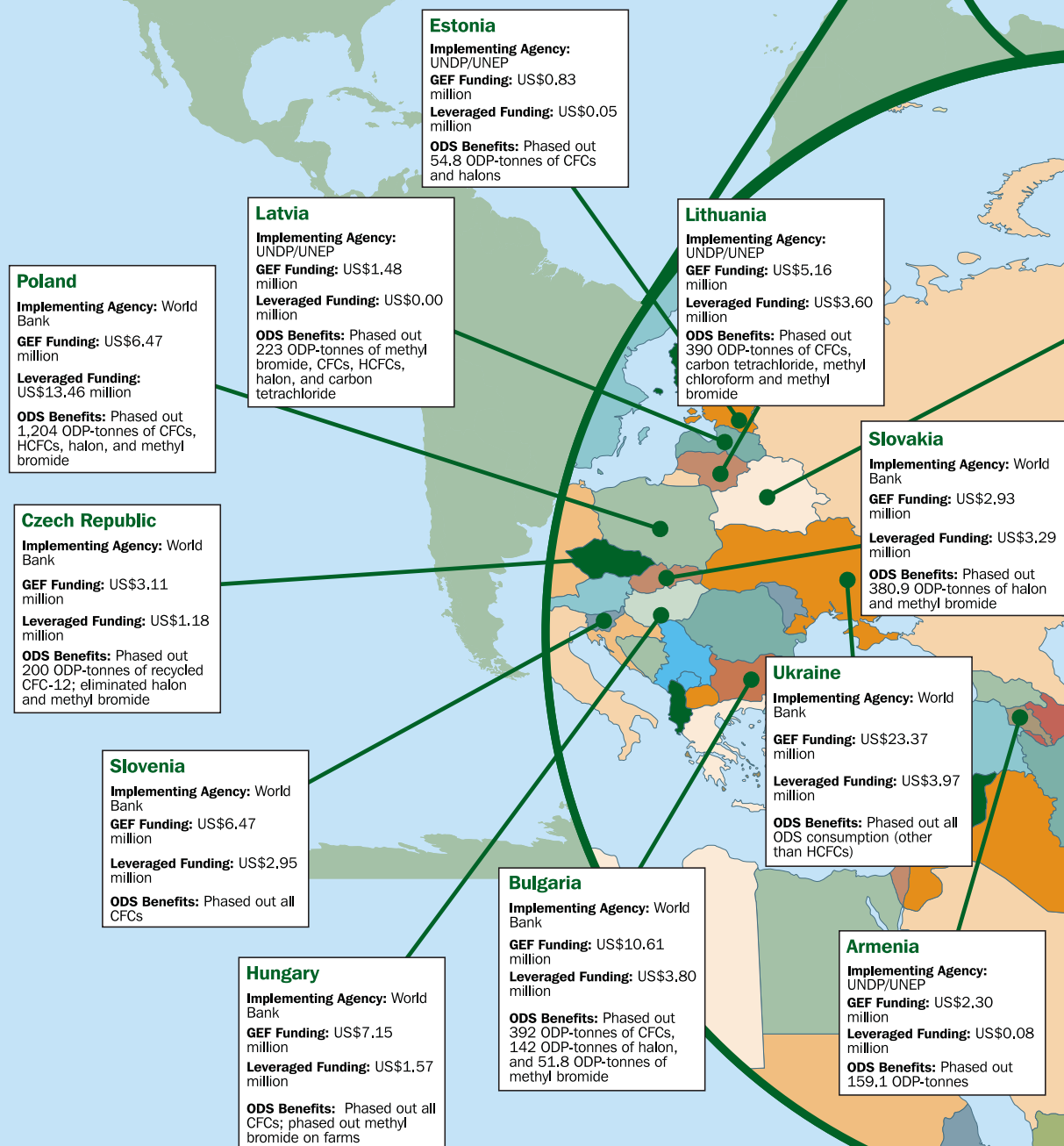
**UNEP**—Focused on projects involving education and outreach, training, and building institutional strength and capacity.



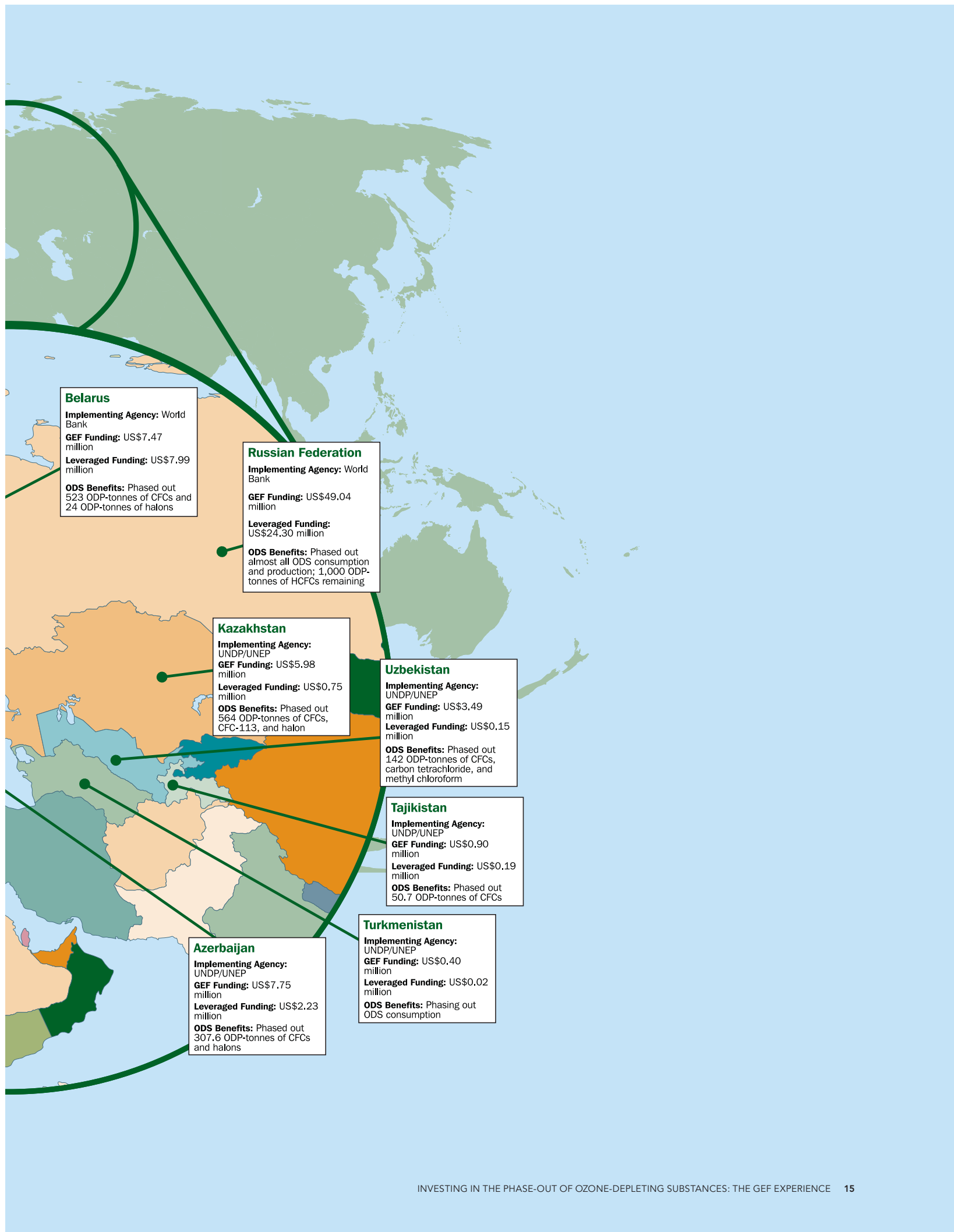
**UNIDO**—Assisted enterprises with the conversion of refrigerant manufacturing plants to energy efficient, HCFC-free technologies.

consumption and production of ODS in Eastern Europe and the republics of the former USSR. GEF-supported projects have helped phase out 20,000 ozone depletion potential (ODP)-tonnes consumption and 29,000 ODP-tonnes production. The GEF plans to build on this success by continuing to support ODS phase-out in CEITs through its fifth funding replenishment cycle (GEF-5).

FIGURE 4 GEF ODS PHASE-OUT INVESTMENTS IN COUNTRIES WITH ECONOMIES IN TRANSITION



**Regional Projects:** GEF Funding US\$6.53 million; Co-financing: US\$6.80 million





# GEF ODS

## PROJECT INVESTMENTS

The following section takes a closer look at GEF-supported projects that have made a difference in phasing out ODS in CEITs (GEF 2009b),<sup>2</sup> as shown in Figure 4. These actions include technical and education activities to transfer technologies and knowledge, as well as activities aimed at strengthening institutions to ensure the existence of necessary policy and regulatory frameworks.

### Armenia<sup>3</sup>

GEF Investment: US\$2.30 million

Co-financing: US\$0.08 million

#### Key Technical and Education Activities

The GEF supported the development of a network of 3R operations and implementation of a national Refrigerant Management Plan targeted at the refrigeration and air conditioning industry. GEF funding supported a technology conversion effort that included technical assistance, training, and an incentive program for end-users. Included in the incentive program were activities to monitor and report on the effectiveness of the Refrigerant Management Plan, and the conversion of two enterprises (a refrigeration plant and an aerosol plant) to non-ODS technologies.

#### Institutional Strengthening Activities

Legislation controlling ODS substances and establishing ODS import quotas, exports, and re-exports was passed in 2006. Assistance was provided to coordinate

implementation of the legislative and policy initiatives, including training of border security and customs officers and providing computer and communications equipment, telecommunications and office supplies, and staff support within the Ministry of Nature Protection, which today remains today as the responsible agency for monitoring the country's ODS.

**ODS Phase-Out:** 159.1 ODP-tonnes<sup>4</sup> by 2008

### Azerbaijan

GEF Investment: US\$7.75 million

Co-financing: US\$2.23 million

#### Key Technical and Education Activities

The GEF supported a project to phase out ODS consumption in the refrigerator industry and to manage halons. In the refrigeration industry, GEF support helped to train refrigerator technicians, distribute equipment for ODS recovery and recycling, and provide two companies—a compressor manufacturing plant and a refrigerator manufacturing plant—with funding to convert their production processes to non-ODS technologies. To manage halons, this project aided Azerbaijan in the establishment of a halon bank.

#### Institutional Strengthening Activities

This project helped pass legislation, policies, and regulations to reduce ODS consumption, including a ban on

<sup>2</sup> These are the achievements of closed projects and do not include discussion of the achievements to be expected from the recently approved regional and Russian Federation HCFC projects under GEF-4.

<sup>3</sup> All financial data refers to actual GEF funding and co-financing calculated as of the October 2009 Impact Report, including regional projects to phase out methyl bromides. Regional projects in GEF-4 to phase out HCFCs in Russia and the Commonwealth of Independent States are not included in the Impact Report but total US\$28.5 million in GEF funding and US\$53.1 million in co-financing.

<sup>4</sup> All ODS phase-out data refers to ODP-tonnes consumed, unless otherwise noted.

halon imports, CFC import quotas, an ODS licensing framework, and a tax on ODS.

**ODS Phase-Out:** 307.6 ODP-tonnes and compliance in all ODS categories by 2006

## Belarus

GEF Investment: US\$7.47 million

Co-financing: US\$2.23 million

### Key Technical and Education Activities

The GEF supported a project to phase out ODS technologies in the refrigeration industry and the solvent sector. In the refrigeration industry, the project supported the conversion of a large refrigerator manufacturer to non-ODS materials, as well as training and equipment to establish 3R capacity in the industrial, commercial, and transportation refrigeration servicing sector. Solvents used in manufacturing processes were targeted by this project through the conversion of four electronics and consumer product manufacturers to use non-ODS solvent technologies in their production processes.

### Institutional Strengthening Activities

This project led to the development of mandatory ODS licensing, training, and certification of personnel and equipment, and establishment of a permitting process for imports and exports.

**ODS Phase-Out:** 523 ODP-tonnes of CFCs and 24 ODP-tonnes of halons by 2000

## Bulgaria

GEF Investment: US\$10.61 million

Co-financing: US \$3.80 million

### Key Technical and Education Activities

The GEF supported three projects to phase out ODS:

### PROJECT HIGHLIGHT: TECHNOLOGY TRANSFER TO ELIMINATE ODS SOLVENTS IN BELARUS

In the early 1990s, many of Belarus's electronics and consumer product manufacturers used ODS-based solvents in their manufacturing processes. GEF funding helped four manufacturers replace these solvents with non-ODS technologies and improve their businesses as a result.

**MINSK COMPUTER COMPANY** used 6 ODP-tonnes CFC-113 and 43 ODP-tonnes methylchloroform to produce printed circuit boards and clean their assemblies. GEF partially funded no-flux wave soldering machines and financed an aqueous cleaning process to replace the use of ODS. The company has since eliminated its ODS use and seen a significant increase in product quality, which improved competitiveness for the company.

**TVETOTRON**, a printed circuit board manufacturer, used GEF funds to replace trichloroethane with an alkaline-development process in the production of circuit boards. As a result, the company eliminated 32 ODP-tonnes of trichloroethane.

**KAMERTON**, a semiconductor and personal electronic products manufacturer used CFC-113 as a cleaning agent in the production of silicon wafers. The company used GEF funding to replace 3.2 ODP-tonnes CFC-113 with a multi-stage acid-alkaline technology. Resulting product quality improvements have enabled Kamerton to compete in Western markets.

**MINSK INSTRUMENT BUILDING COMPANY** manufactures a wide variety of radio and electronic devices, medical equipment, and related systems. The company used a significant amount of CFC-113 in de-preservation, cleaning, and degreasing printed circuit board assemblies. GEF funding enabled the replacement of these systems with a high-volume aqueous cleaning process and associated equipment, which resulted in an elimination of 6.2 ODP-tonnes of CFC-113 and the production of higher quality products.

**ODS PHASE-OUT:** A total of 15.4 ODP-tonnes of CFCs, 43 ODP-tonnes of methylchloroform, and 32 ODP-tonnes trichloroethane were eliminated.

- **ODS Phase-Out (1995–2000):** This project focused on phasing out all ODS except for methyl bromide and HCFCs by training technicians in refrigeration management, distributing equipment for ODS 3R activities, and assisting six enterprises (three refrigerated display cabinet manufacturers, two refrigerator producers, and one ball bearing manufacturer) in eliminating ODS.

- **Initiating Early Phase-Out of Methyl Bromide in CEITs (2000–2002):** This project aimed to reduce the use of methyl bromide in Bulgaria by conducting awareness-raising activities on methyl bromide and its alternatives, developing a policy for methyl bromide phase-out, and implementing demonstration and training activities on methyl bromide alternatives.
- **Total Sector Methyl Bromide Phase-Out in CEITs (2004–2008):** In accordance with the Copenhagen Amendment, this regional project aimed to phase out all uses of methyl bromide (except those used for quarantine and pre-shipment) by training farmers and post-harvest specialists on alternatives to methyl bromide and providing two agricultural supply and service companies with non-ODS equipment.

#### **Institutional Strengthening Activities**

GEF support enabled the establishment of a licensing system, a ban on CFC imports, penalties for venting CFCs, installation fees for HCFCs and methyl bromide, import quotas for HCFCs, and a deadline for ending the use and trade of HCFCs. Bulgaria also imposed policies on the recovery and recycling of CFC-12.

**ODS Phase-Out:** 392 ODP-tonnes of CFCs, 142 ODP-tonnes of halon, and 51.8 ODP-tonnes of methyl bromide; compliance with the Protocol in January 1998

## **Czech Republic**

GEF Investment: US\$3.11 million

Co-financing: US\$1.18 million

#### **Key Technical and Education Activities**

The GEF supported a project to develop and implement a comprehensive ODS phase-out program. In addition to establishing ozone protection legislation, this project helped to develop a network of 3R operations and programs to train refrigerant technicians on best practices in recovering CFCs, and to install 500 recycling and recovery machines for use in the Czech Republic's refrigeration servicing industry.

#### **Institutional Strengthening Activities**

This project established an ODS permitting and quota system and established taxes on producers and importers of ODS, with revenue directed to a state-managed Environmental Fund for Ozone Layer Protection.

**ODS Phase-Out:** 200 ODP-tonnes of recycled CFC-12 due to 500 recycling and recovery machines; eliminated halon and methyl bromide in 1996

## **Estonia**

GEF Investment: US\$0.83 million

Co-financing: US\$0.05 million

#### **Key Technical and Education Activities**

GEF-supported activities included establishing a network of refrigerant 3R centers, training trainers in refrigerant recovery, and developing an awareness-raising campaign to encourage the recovery of unwanted refrigerators that contained ODS. This project also involved providing a regional center for the recovery of halon in the Baltic states.

#### **Institutional Strengthening Activities**

This project also led to enactment of ODS legislation, including banning the import of products containing CFCs and halons, developing procedures for labeling and licensing ODS, banning the import of CFCs and halons, establishing a national reporting system for 3R ODS, and requiring certification for persons handling ODS and fluorinated gases.

**ODS Phase-Out:** 54.8 ODP-tonnes and remains compliant with the Montreal Protocol

## Hungary

GEF Investment: US\$7.15 million

Co-financing: US\$1.57 million

### Key Technical and Education Activities

The GEF supported three projects to phase out ODS:

- **ODS Phase-Out (1995–1998):** This project aimed to phase out all targeted ODS except for methyl bromide and HCFCs. Activities included establishing a 3R network and assisting 10 enterprises (commercial cooling, foam, aerosol, and medical equipment manufacturers, as well as other solvent-using facilities) to eliminate their use of CFCs.
- **Initiating Early Phase-Out of Methyl Bromide in CEITs (2000–2002):** Activities to phase out methyl bromide focused on raising awareness (including the development of pest control guides and regional warning and recommendation leaflets), expanding the use of ODS-free artificial soil, and educating trainers on methyl bromide alternatives.
- **Total Sector Methyl Bromide Phase-Out in CEITs (2004–2008):** As in Bulgaria, this regional project aimed to phase out all uses of methyl bromide (except those used for quarantine and pre-shipment) in accordance with the Copenhagen Amendment. This project involved delivering “train-the-trainer” courses, providing equipment to eliminate methyl bromide use for soil pests, and training farmers on alternatives to methyl bromide.

### Institutional Strengthening Activities

This project banned new uses of ODS, required that qualified technicians work on ODS equipment, required disassembly and disposal of ODS in authorized areas, restricted the use of halon, limited quantities of methyl bromide, and required record keeping for ODS greater than 100 kg.

**ODS Phase-Out:** Zero ODS consumption in Hungarian enterprises; elimination of methyl bromide on farms

## Kazakhstan

GEF Investment: US\$5.98 million

Co-financing: US\$0.75 million

### Key Technical and Education Activities

The GEF-supported project to phase out ODS provided companies with equipment to eliminate the use of CFCs in flexible and rigid foam production financed the replacement of CFC-113 with methylene chloride in chlorine production processes, and supported a halon bank and reclamation service awareness campaign. The project also helped to establish a network of 3R operations and to conduct training seminars on environmentally safe procedures for installing, maintaining, and repairing air conditioning and refrigeration equipment.

### Institutional Strengthening Activities

GEF support helped to enact several legislative measures designed to phase out ODS, including: restricted repair, service, and assembly of ODS equipment; a ban on the import of Annex A, B, and E substances and products that contain them; development of a licensing system for the import and export of ODS; establishment of ODS emissions limits for enterprises; and a requirement for companies to pay “ecological insurance.”

**ODS Phase-Out:** 564 ODP-tonnes by January 2004; since 2005, compliance with all ODS requirements except for methyl bromide

## Latvia

GEF Investment: US\$1.48 million

Co-financing: \$0.00 million

### Key Technical and Education Activities

Three GEF-supported projects included:

- **ODS Phase-Out (1997–2007):** This project aimed to phase out all targeted ODS except for methyl bromide and HCFCs. Activities included establishing

### PROJECT HIGHLIGHT: USING LOANS TO PHASE OUT METHYL BROMIDE IN LATVIA

The costs of addressing Protocol targets for methyl bromide phase-out in Latvia were out of reach of most farmers, agricultural agencies, and other organizations that used the ODS to remove insects, termites, rodents, weeds, and fungi from agricultural fields, grain elevators, mills, and greenhouses.

To enable these critical producers to phase out their use of methyl bromide without sacrificing the economic stability of their businesses, the GEF supported the establishment of an Environment Investment Fund. The fund provided loans to farmers, food processors, and agricultural organizations for the implementation of environmentally sustainable practices considered valuable as mitigation strategies against methyl bromide.

The loans provided by the GEF were used by farmers to meet their specific phase-out needs. Funding helped to finance non-ODS practices for pest control and irrigation, including alternative chemicals, process efficiency improvements, and steam treatments. In many cases, funding was also used to provide technical advisory services, farm worker training, and pilot projects on farms.

**ODS PHASE-OUT: Latvia's success in phasing out over 200 ODP-tonnes of ODS by 2008 was directly tied to the financial support of the GEF-funded Investment Fund.**

a 3R network, training refrigeration technicians, and providing 40 recovery and recycling machines to companies and 2 CFC-12 machines to reclamation centers. The project also replaced CFC-based technologies with alternatives at a foam spray manufacturer and an aerosol manufacturer.

- *Initiating Early Phase-Out of Methyl Bromide in CEITs* (2000–2002): Activities to phase out methyl bromide focused on raising awareness on the use of methyl bromide and its alternatives, conducting fumigator training courses, and providing non-ODS equipment for pest control in mills.
- *Total Sector Methyl Bromide Phase-Out in CEITs* (2004–2008): This regional project provided companies in the postharvest sector with phosphine fumigation equipment and training to eliminate 8.8 ODP-tonnes of methyl bromide.

### Institutional Strengthening Activities

Latvia passed a number of legislative initiatives, including an ODS licensing system and tax on ODS imports; import quotas for CFCs, HCFCs, and carbon tetrachloride; qualifications and certifications for refrigerant technicians; bans on halon and CFC imports; a voluntary ODS consumption freeze by importers and users; and regulations on fluorinated gases to comply with European Union legislation.

**ODS Phase-Out:** 223 ODP-tonnes by 2008, 22 ODP-tonnes of which came from participating enterprises

## Lithuania

GEF Investment: US\$5.16 million

Co-financing: US\$3.60 million

### Key Technical and Education Activities

The three GEF projects included:

- *ODS Phase-Out* (1998–2001): This project aimed to phase out all ODS except for methyl bromide and HCFCs. Activities included establishing a 3R network, training technicians in best practices for refrigerant management, and financing 50 recovery and recycling machines and 3 reclamation units. The project also supported an ODS-awareness campaign and provided funding to a refrigerator manufacturer, an aerosol enterprise, and a compressor manufacturer to eliminate their uses of ODS.
- *Initiating Early Phase-Out of Methyl Bromide in CEITs* (2000–2002): Activities to phase out methyl bromide focused on raising awareness about the use of methyl bromide and its alternatives, developing policies for methyl bromide phase-out, and providing non-ODS equipment for pest control in mills.
- *Total Sector Methyl Bromide Phase-Out in CEITs* (2005–2008): This regional project provided companies in the postharvest sector with phosphine fumigation equipment and training to phase out all uses of methyl bromide except for quarantine and pre-shipment.

### Institutional Strengthening Activities

GEF support helped to develop laws, regulations, and policies designed to eliminate the consumption of ODS,

## PROJECT HIGHLIGHT: TECHNOLOGY TRANSFER TO PHASE-OUT CFCs AT A REFRIGERATOR MANUFACTURER IN LITHUANIA

As part of the larger project to reduce ODS in Lithuania, the GEF focused on providing manufacturers with GEF funding to convert their ODS technologies to non-ODS technologies.

**SNAIGÉ**, the only domestic refrigerator and freezer manufacturer in the Baltic, received GEF funding for nearly all of the steps to replace the CFCs used in the insulating foam and compressors of their products. CFC foam was replaced with cyclopentane-blown rigid polyurethane insulation foam, and CFC refrigerant was replaced with R600a for use in the compressors.

GEF funding enabled Snaigė to put in place modern production and refrigeration technologies that increased production capacity and reduced production costs and labor. The resulting refrigerators reduced energy demand and improved environmental compliance, making them more attractive on a cost basis to consumers in EU markets, especially where government rebates were offered for the purchase of environmentally sound technologies.

**ODS PHASE-OUT:** A total of 112 ODP-tonnes of CFCs were eliminated, equivalent to 29% of ODS consumption in Lithuania in 1995.

including: legislation to fulfill Lithuania's ODS and Environmental Action Plan goals; licensing for storing ODS; import quotas for ODS; ban on the use of CFCs in new refrigeration, air conditioning, foam production, and aerosol equipment; and restricted use of methyl bromide and fluorinated gases.

**ODS Phase-Out:** 390 ODP-tonnes of ODS; zero ODS consumption for CFCs, carbon tetrachloride, and methyl chloroform in 2001; successfully recovered enough CFCs to meet servicing needs while phasing out methyl bromide by January 2005

## Poland

GEF Investment: US\$6.47 million

Co-financing: US\$13.46 million

### Key Technical and Education Activities

The three GEF projects included:

- **ODS Phase-Out (1997–2001):** This project aimed to phase out all ODS, except for methyl bromide and HCFCs, by assisting six manufacturers (refrigerators, freezers, pipe insulation, sandwich panels, pharmaceutical supplies and medical equipment, and refrigerator compressors) to eliminate their use of CFCs. This

project also established a 3R operations network that involved training technicians in refrigeration management and distributing equipment for 3R, including 550 portable ODS recovery units and a reclamation unit, among others. In addition this project supported training on halon recovery and banking as well as outreach on ozone layer protection.

- **Initiating Early Phase-Out of Methyl Bromide in CEITs (2000–2002):** Activities to phase out methyl bromide focused on raising awareness about the use of methyl bromide and its alternatives and conducting a demonstration project that tested various chemical and non-chemical combinations on several crops in open fields. The project also included training for soil and post-harvest workers on alternative technologies.
- **Total Sector Methyl Bromide Phase-Out in CEITs (2005–2008):** This regional project provided methyl bromide alternatives to two companies—a chemical and bio-control services company and a seed production and marketing company—for use in post-harvest pest control.

### Institutional Strengthening Activities

GEF support enabled the implementation of a number of legislative actions, including taxes on CFCs and other ODS; a ban on new halon equipment and use on ships; a licensing system for the import and export of ODS; and a ban on new equipment containing CFCs, HCFCs, and halon.

**ODS Phase-Out:** 1,204 ODP-tonnes during the project timeline, meeting CFC targets in six enterprises, including the recovery of up to 60 ODP-tonnes

## Russian Federation

GEF Investment: US\$49.04 million

Co-financing: US\$24.30 million

### Key Technical and Education Activities

From 1996 to 2004, GEF supported a project to monitor ODS demand and phase-out and to implement a public awareness campaign, as well as projects to reduce ODS in the refrigerator, foam, and aerosol sectors. The GEF's Ozone and Climate Change focal areas collaborated on the project to phase out HCFCs in the refrigerator and foam sectors, which involved installing environmentally sound non-ODS technologies for these applications. The project to eliminate CFC propellants in seven major aerosol production companies was completed in three stages: replacement of targeted manufacturing facilities; purchase of new filling lines to use hydrocarbon aerosol propellants (HAPs); purification of HAPs and construction of HAP storage and handling facilities.

### Institutional Strengthening Activities

This project developed a regulatory framework for the management of ODS to achieve compliance with the Protocol. The Russian Federation enacted nine laws between May 1995 and June 2001 to phase out ODS, including a ban on the import of ODS, ODS-containing products, and new production facilities.

**ODS Phase-Out:** ODS consumption and production (other than HCFCs) almost completely phased out. More than 1,000 ODP-tonnes of HCFC consumption expected to be phased out.

## Slovakia

GEF Investment: US\$2.93 million

Co-financing: US\$3.29 million

### Key Technical and Education Activities

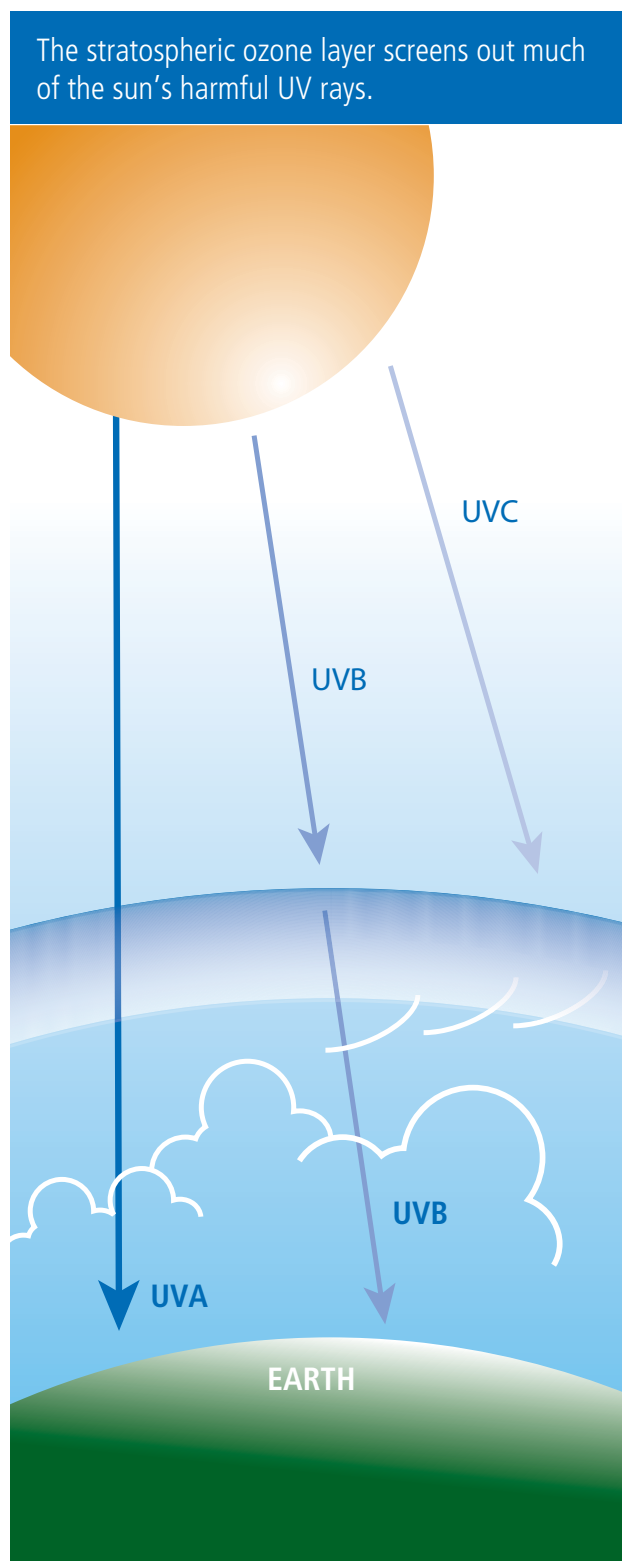
The GEF project converted two refrigerator manufacturing plants to non-ODS technologies and established a halon management bank to enable the gradual replacement of halon with alternatives.

## PROJECT HIGHLIGHT: CO-FINANCING AND PARTNERSHIP BUILDING TO PHASE OUT CFCs AT A REFRIGERATOR MANUFACTURER IN RUSSIA

**JSC ICEBERG** produces cost-effective refrigerators that offer an alternative to expensive imports. Recognizing the need to eliminate the CFCs it used in its compressor and foam-blowing operations, the company co-financed (US\$156,166) a GEF investment of US\$629,059 in a CFC phase-out project. GEF funding provided the company with the additional resources they needed to overcome the initial cost hurdles that often prevent the private sector from buying into environmentally sound practices.

Under this project, JSC Iceberg was able to convert its operations to use alternatives to CFCs. GEF funding enabled the purchase of equipment such as vacuum pumps, foaming dispensers, and recovery and recycling equipment for both production and service facilities. The company's co-financing went toward installation, plant modifications, environmental approvals, and engineering costs.

The GEF-supported project also made possible the mutually beneficial cooperation between JSC Iceberg and Atlant, a company that was also receiving assistance from the GEF. This business opportunity enabled JSC Iceberg to increase the number of its models from 3 to 12, using the Atlant brand for several of them. The increase in product offerings has improved the profile of the company, expanded its production capacity to 500,000 units per year, and enhanced its financial security.



The sun emits ultraviolet radiation in the UVA, UVB and UVC bands. The Earth's ozone layer blocks 97-99% of this UV radiation from penetrating the atmosphere. Of the ultraviolet radiation that reaches the Earth's surface 98.7% is UVA.

Source: [www.epa.gov/sunwise/uvindex.html](http://www.epa.gov/sunwise/uvindex.html)

### Institutional Strengthening Activities

GEF support helped to ban the production and consumption of methyl bromide and to establish a licensing system for the import and export of ODS and ODS-containing equipment.

**ODS Phase-Out:** Transitioned from consuming 380.9 ODP-tonnes in 1995 to zero in 1996. Imports of methyl bromide ended in 1999—ahead of the Protocol schedule for non-Article 5 Parties.

## Slovenia

GEF Investment: US\$6.47 million

Co-financing: US\$2.95 million

### Key Technical and Education Activities

Between 1989 and 1995, the GEF helped fund five refrigeration equipment, aerosol, sandwich panel, and dry cleaning companies to completely phase out ODS. Slovenia also worked with the largest refrigerator and heat pump servicing organization in the country to implement a 3R program for these companies, and conducted training on best practices in refrigeration and air conditioning.

### Institutional Strengthening Activities

Slovenia banned the import of CFCs and established requirements for enterprises to provide an environmental and safety report and for refrigeration technicians to be licensed. Its legislature also developed an ODS licensing system, established a permitting system for ODS, and banned venting of ODS.

**ODS Phase-Out:** Almost zero ODS within two years of the project's start—85% reduction

## Tajikistan

GEF Investment: US\$0.90 million

Co-financing: US\$0.19 million

### Key Technical and Education Activities

The GEF supported development and implementation of a 3R operations program and a national Refrigerant Management Plan—a retrofit financial incentive program for the refrigeration industry. Included in this incentive program were activities to monitor and report on the plan, train technicians, raise awareness, and convince a refrigerator manufacturer to replace CFC-based equipment with new, alternative equipment.

### **Institutional Strengthening Activities**

The GEF supported a legislative process for addressing ODS, halted ODS consumption, established a licensing system for ODS import and export, and developed an import quota system.

**ODS Phase-Out:** 50.7 ODP-tonnes of ODS; returned to compliance with the Protocol in 2006

## **Turkmenistan**

GEF Investment: US\$0.40 million

Co-financing: US\$0.02 million

### **Key Technical and Education Activities**

Beginning in 1998, the GEF supported the development of Country and Refrigeration Management Plans. Projects to achieve these plans included monitoring ODS phase-out activities, training refrigeration technicians and customs officers, and providing for the service, maintenance, and repair of existing refrigeration systems.

### **Institutional Strengthening Activities**

GEF support helped passed a series of laws and regulations on the use of ODS, requiring that the import and export of chemicals and fertilizers be licensed and subject to quotas.

**ODS Phase-Out:** Achieved 85% reduction in ODS consumption by 2007.

## **Ukraine**

GEF Investment: US\$23.37 million

Co-financing: US\$3.97 million

### **Key Technical and Education Activities**

The GEF supported a project to assist eight high-ODS consuming enterprises in the refrigeration manufacturing and chemical fields to switch to non-ODS technologies prior to the introduction of a ban on ODS imports. This project also provided assistance to two servicing companies in establishing ODS 3R centers, including the preparation of teaching materials and the organization of training courses for refrigeration servicing technicians. In addition, this project covered the establishment of a halon collection, recycling, and

reclamation facility and the preparation of a Halon Management Plan.

### **Institutional Strengthening Activities**

The country adopted numerous laws and regulations to address ODS production and use, including outright bans and quotas, strict import and export requirements, development of a national program to halt ODS production and use, and a comprehensive program for fire safety assurance, which specified standards for development and production of fire extinguishing devices and substances. In addition, border control inspectors were trained to carry out their critical enforcement role. ODS phase-out activities are now implemented by the Ozone and Greenhouse Gas unit of the Department of Air Protection and Climate.

**ODS Phase-Out:** 800–1,400 ODP-tonnes to comply with the Protocol by 2002; eliminated ODS consumption (other than HCFCs) by 2006

## **Uzbekistan**

GEF Investment: US\$3.49 million

Co-financing: US\$0.15 million

### **Key Technical and Education Activities**

The GEF-supported project included establishing a network of 3R operations, providing a training course to refrigerant technicians on the best practices of refrigerant management to minimize emissions of CFCs in stationary air conditioning, and eliminating the use of CFCs in domestic refrigerators.

### **Institutional Strengthening Activities**

GEF support helped to pass legislation to institute a licensing and taxing system for ODS, banned imports of specific ODS, and established standards for the import and export of ODS products.

**ODS Phase-Out:** 142 ODP-tonnes and zero consumption of CFCs, carbon tetrachloride, and methyl chloroform since 2002



# Looking Ahead

The ODS phase-out associated with GEF projects—an estimated 20,000 ODP-tonnes since 1991—made a substantial contribution to the more than 95% reduction in ODS consumption the 18 CEITs have achieved since 1991. These reductions, in addition to the overall success of the Montreal Protocol, have made significant progress in reversing ozone depletion; by 2065, ODS phase-out efforts are expected to return the ozone layer to pre-1980 levels (GEF 2009a).

Progress has also been made in other ways. The total reduction of CO<sub>2</sub>e by CEITs over the time period 1989-2007 has been calculated at 1,273 million tonnes CO<sub>2</sub>e, which includes all of the ODS reductions made by CEITs before the GEF program. 105 million tonnes CO<sub>2</sub>e, reduction in ODS consumption, or 8% of the total reductions made by CEITs through 2007, is attributable to the GEF program (GEF 2009a).

The health benefits of this substantial phase-out are also evident. It is estimated that if the Montreal Protocol had not been established, ozone depletion by 2050 would have reached 50% in northern mid-latitudes and 70% in southern mid-latitudes, doubling and quadrupling the UV-B radiation reaching earth, respectively (Ozone Secretariat 2008). The Montreal Protocol is essentially avoiding an estimated 210,100 cases of non-melanoma skin cancer, 16,500 cases of melanoma skin cancer, 3,669 skin cancer fatalities, and 1,420,100 cases of cataracts (GEF 2009a).

The reduction in ODS has also been beneficial from an economic standpoint. The Montreal Protocol's Technology and Economic Assessment Panel co-chair has noted that ODS reductions and complete phase-outs have enhanced the competitiveness of both large and small companies in CEITs. By identifying alternatives for targeted ODS, installing these new technologies, and thus reducing costs

for companies across the board, companies were able to provide consumers with alternative or substitute products that were similar in price (GEF 2009a). Reducing and eliminating ODS consumption according to the Protocol's timeline has enabled refrigerant, aerosol, foam, and solvent manufacturers in CEITs to utilize GEF financing to install more efficient and environmentally friendly technologies. And, in numerous cases, enterprises that switched to ODS-free technologies as a result of their involvement in GEF projects have increased their profits and expanded their market reach.

Looking ahead, the GEF plans to build on the success of its previous ODS phase-out projects by investing funding from its fifth funding replenishment cycle (GEF-5) to continue to help non-Article 5 CEITs achieve Protocol targets. The GEF's work to date has facilitated a large drop in the consumption and production of CFCs, but additional efforts are still needed to fully address reductions of other ODS, such as HCFCs.

Much of the GEF's work in GEF-5 will focus on taking advantage of the interrelated nature of global environmental issues like climate change, chemicals management, biodiversity and sustainable land management. Specifically, synergy will be strengthened between sound chemicals management under the Montreal Protocol and the collection and destruction of persistent organic pollutants under the Stockholm Convention. Similarly, synergy between ODS phase-out and climate change mitigation can be developed through projects that replace old HCFC-based chillers, air-conditioners, and refrigerators with new energy-efficient equipment that use chemicals with low global warming potential. By including ODS phase-out throughout its portfolio, the GEF will continue to support projects that deliver multiple global environmental benefits.

## ABBREVIATIONS

|                   |   |
|-------------------|---|
| <b>3R</b>         | recycling, recovery, and reclamation        |
| <b>CIS</b>        | Commonwealth of Independent States          |
| <b>CEITs</b>      | countries with economies in transition      |
| <b>CFCs</b>       | chlorofluorocarbons                         |
| <b>EC</b>         | European Commission                         |
| <b>ECA</b>        | Europe and Central Asia                     |
| <b>EECI</b>       | Effective Equivalent Troposphere Chlorine   |
| <b>GEF</b>        | Global Environment Facility                 |
| <b>HAP</b>        | hydrocarbon aerosol propellant              |
| <b>HCFCs</b>      | hydrochlorofluorocarbons                    |
| <b>HFCs</b>       | hydrofluorocarbons                          |
| <b>MLF</b>        | Multilateral Fund                           |
| <b>ODP</b>        | ozone depletion potential                   |
| <b>ODP-tonnes</b> | ozone depletion potential-tonnes            |
| <b>ODS</b>        | ozone-depleting substances                  |
| <b>POPs</b>       | persistent organic pollutants               |
| <b>R&amp;D</b>    | research and development                    |
| <b>UNDP</b>       | U.N. Development Programme                  |
| <b>UNEP</b>       | U.N. Environment Programme                  |
| <b>UNFCCC</b>     | U.N. Framework Convention on Climate Change |
| <b>UNIDO</b>      | U.N. Industrial Development Organization    |
| <b>UNOPS</b>      | U.N. Office for Project Services            |
| <b>UV</b>         | ultraviolet                                 |

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## ABOUT THE GEF

The Global Environmental Facility unites 182 member governments—in partnership with international institutions, nongovernmental organizations, and the private sector—to address global environmental issues. An independent financial organization, the GEF provides grants to developing countries and countries with economies in transition for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. These projects benefit the global environment, linking local, national, and global environmental challenges and promoting sustainable livelihoods.

Established in 1991, the GEF is today the largest funder of projects to improve the global environment. The GEF has allocated US\$9.2 billion, supplemented by more than US\$40 billion in co-financing, for more than 2,700 projects in more than 165 developing countries and countries with economies in transition. Through its Small Grants Programme, the GEF has also made more than 12,000 small grants directly to nongovernmental and community organizations.

The GEF partnership includes 10 Agencies: the UN Development Programme, the UN Environment Programme, the World Bank, the UN Food and Agriculture Organization, the UN Industrial Development Organization, the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, the Inter-American Development Bank, and the International Fund for Agricultural Development. The Scientific and Technical Advisory Panel provides technical and scientific advice on the GEF's policies and projects.

[www.theGEF.org](http://www.theGEF.org)



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