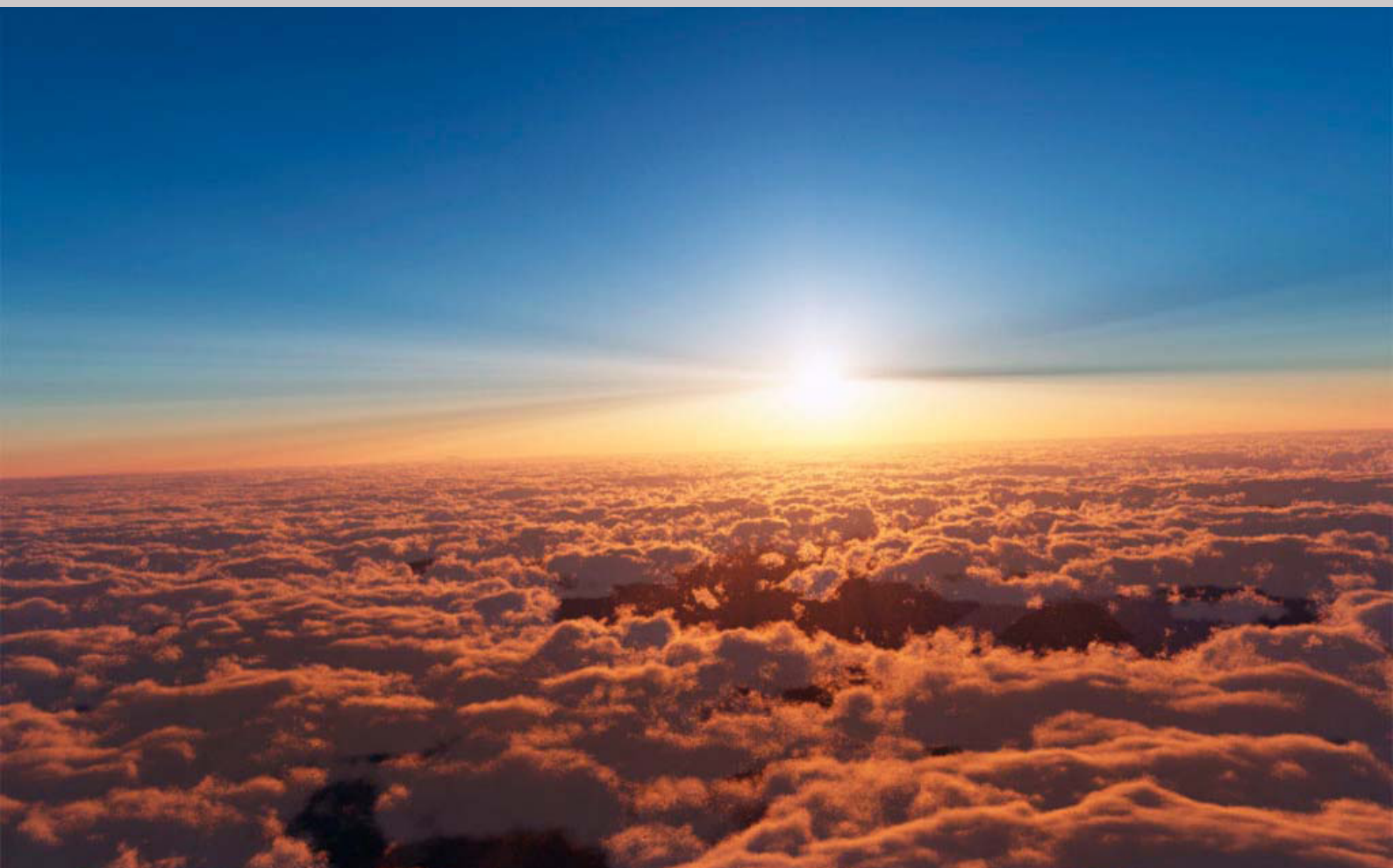


Montreal Protocol on Substances that Deplete the Ozone Layer

“Celebrating 20 years of progress in 2007”



Recognition of some of the Exemplary
Projects that have been undertaken
pursuant to Article 10 of the
Montreal Protocol

Ozone Secretariat

United Nations Environment Programme

Exemplary Projects Undertaken Pursuant to Article 10 of the Montreal Protocol

When the Montreal Protocol was originally negotiated in 1987, the negotiators understood clearly that their initial effort was a work in progress. Nowhere was this more clear than with regard to Article 10 of the Protocol. Among other things, that nascent provision called on the Parties to the Protocol to begin deliberations at their first meeting on the development of workplans to assist developing countries in complying with their obligations under the Protocol. The promise of this provision was not fully realized until 1990, when Article 10 of the Protocol was amended to provide for the establishment of a financial mechanism to provide financial and technical cooperation, including technology transfer, to developing countries to enable their compliance with the Montreal Protocol. A particularly notable feature of Article 10 was its call for the financial mechanism to include a multilateral fund.

Since 1990, when the Interim Multilateral Fund was established, the Multilateral Fund has approved over 5,500 projects and activities in over 140 countries which, when fully implemented, are expected to eliminate over 235,546 ODP tonnes of production and over 173,616 ODP tonnes of consumption¹ of ozone-depleting substances. Each of those projects and activities represents the strong commitment of a Party operating under Article 5 of the Protocol to implement the Protocol and is therefore deserving of both recognition and praise. Each of those projects should also be applauded because of the tremendous effort behind it. Indeed, no one should ever underestimate the difficulty of project development and implementation. Although over time the Fund, the implementing agencies and the national ozone units have developed a great deal of efficiency in their work, the fact remains that no matter how many conversions of seemingly similar users have taken place, each one involves the operation of literally hundreds of different steps, and each one must be fine tuned to meet the specific needs of each user. Indeed, the development and implementation of a successful project involves so much communication and so many hand-offs that it is a small miracle that the success rate of Multilateral Fund projects is so very high. This truly is a testament to the commitment of the experts in the countries, the enterprises and the implementing agencies that make the projects possible.

In an effort to share with the Parties and the world community a small measure of what has been achieved under Article 10 of the Protocol, the Ozone Secretariat invited nominations for “exemplary projects” undertaken through the Multilateral Fund. Over 70 projects were nominated and have been reviewed by representatives of the Multilateral Fund’s four implementing agencies (the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the United Nations Industrial Development Organization (UNIDO) and the World Bank), the Multilateral Fund Secretariat, the Ozone Secretariat and the Chairman of the Executive Committee of the Multilateral Fund. This brochure contains a brief overview of those projects which have received the support of a majority of the reviewers. The projects contained in the brochure represent but a small subset of the outstanding work that has been done by the Parties, implementing agencies, enterprises and global entities under Article 10, a Protocol provision that has spawned what we believe to be the most innovative and successful effort ever to facilitate global compliance with an environmental treaty.

¹ The ozone-depleting potential of the various ozone-depleting substances varies. “Ozone-depleting tonnes” (ODP tonnes) are derived from metric tonnes by multiplying the number of metric tonnes by the factors given in Annexes A, B, C and E to the Montreal Protocol for the various substances. Where the factor is 1, as for CFC-11 and CFC-12 among others, the two are equivalent.

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China Halon Sector Plan. World Bank

During the first years of operation of the Multilateral Fund, the Parties to the Protocol tended to work on a project-by-project basis. The China Halon Sector Plan signalled a break from this approach. Approved in 1997, the China Halon Sector Plan constituted the first effort by the Fund, or by any country, to tackle production and consumption of ozone-depleting substances within a country on a sector-wide basis. Specifically, the project envisioned that the Fund would pay China \$62 million over a period of years and that the funding would be provided in annual tranches, based on verification that China had met specific milestones in reducing the production and consumption of halons. The agreement also provided flexibility to enable China and the World Bank (the implementing agency for the project) to spend related resources to meet the agreed annual reduction targets.

This latter provision helped spawn a host of innovative modes of implementation. Among the most notable are the use of a reverse auction to distribute the reduction requirements among halon producers. Specifically, halon producers proffered bids representing the level of funding which they would offer to achieve a specific level of reductions (in metric tonnes), as a result of which the Government achieved the lowest-cost reductions possible by awarding grants to the lowest-price bidders. Understanding the need to build capacity to ensure the effective implementation and enforcement of the phase-out, the Government also used part of the funding provided by the Fund for technical assistance projects. Lastly, a portion of the funds was used to enable the creation of capacity for producing alternatives to halons.

The implementation of the China Halon Sector Plan has been a significant success for both China and the ozone layer. China has achieved almost all its reduction targets well ahead of the schedules originally agreed in the project. It has also introduced alternatives and substitute fire-protection technologies and eliminated around 36,000 ODP tonnes in both the production and the consumption of halons. The Chinese team developing the plan consisted of Mr. Liu Yi, Professor Hu Jianxing, Mr. Ru Jiang and Mr. Hu Xiaofeng. The World Bank team working on the project included Ms. Helen Chan, Ms. Jessica Poppele, Mr. Donald Brown, Mr. Roy Pepper and Mr. Erik Pedersen.

Projects to Phase-Out Methyl Bromide in the Tobacco Sector in Malawi (UNDP) and the Former Yugoslav Republic of Macedonia (UNIDO)

Methyl bromide is a highly potent and effective agricultural fumigant that has been used in many countries for decades. One of the largest uses of methyl bromide in developing countries has been as a soil fumigant for tobacco cultivation. As tobacco is an important cash crop for many developing countries, the prospect of phasing this use out caused considerable concern. Indeed, the phase-out of this use has constituted both a significant challenge and one of the most significant methyl bromide achievements of the Multilateral Fund to date.

Malawi

The Malawi methyl bromide phase-out project exemplifies the challenges faced in this sector. One challenge relates to the sheer size of the sector. In Malawi, methyl bromide was used by a large number of tobacco farmers and labourers, including many small-scale growers who had little or no formal education and were located in hard-to-reach areas. At the time of the project's inception, it was estimated that there were over 400,000 farmers using methyl bromide in Malawi.

Early on, the Government established a national project steering committee comprised of dedicated high-level stakeholders from the public and private sectors. Malawi's Agricultural Research and Extension Trust (ARET), a national institution with close ties to the country's principal agricultural production sector stakeholders, was tasked with the project's management. This served to enhance the credibility of project implementation among stakeholders. The close cooperation between stakeholders also served to support capacity development by encouraging the local production of materials to support the adoption of a "floating tray system" as an alternative to methyl bromide use, thereby developing local and regional market potential for small businesses and enhancing the long-term sustainability potential of the transition away from methyl bromide use through the development of cost-effective alternatives.

The project was also able to leverage other significant national goals. In particular, the project's outreach activities in rural areas offered an avenue at the rural community level to disseminate HIV/AIDS-related messages developed by national stakeholders associated with the Malawi National Aids Commission. Thus, the project supported not only the phase-out of methyl bromide but also HIV/AIDS education.

In all, \$2,999,824 of funding was approved in principle to support the phase-out of 185 metric tonnes a year of methyl bromide consumption. As a result of this project, Malawi was able to meet the accelerated phase-out targets it had set for itself, reaching full methyl bromide phase-out by 1 January 2005.

The Former Yugoslav Republic of Macedonia

The use of methyl bromide as a soil fumigant was also phased out completely in tobacco sector in the former Yugoslav Republic of Macedonia. Tobacco is a major crop in that country, which produces over 34,680 tonnes of tobacco leaves a year. In 1998, the country's cultivated surface area totalled 22,000 hectares (average yield = 1,580 kg/ha). Over half of its total tobacco production is exported. Annual sales are of the order of \$80 million, and provide high revenue for farmers, estimated at \$2,000 per hectare per year. Ten per cent of Macedonia's population is employed in the tobacco industry, which produces two types of tobacco, the Oriental variety, accounting for 94 per cent of total production, and the Virginia variety, making up the remaining 6 per cent. Based on the excellent results of an initial demonstration project, tobacco farmers chose to change their mode of production completely by adopting soilless cultivation using a floating tray technology system. In the process of implementation, UNIDO had to adapt this technology to the predominantly grown Oriental plant, which is considerably smaller in size than is the Virginia. While challenging, the project proved to be a success, and 41.3 tonnes (24.78 ODP tonnes) of annual methyl bromide use was eliminated as the use of the substance in Macedonia's tobacco industry was completely phased out. Moreover, the implementation of the floating tray technology yielded the same production levels as the pre-phase-out baseline, but with higher-quality plants.

Green Customs Initiative (GCI). UNEP

It has long been understood that if Parties are to meet the requirements of the Montreal Protocol they must be able to control the movement of ozone-depleting substances across their borders. Indeed, effective implementation of many multilateral environmental agreements depends on effective border controls. The recognition of this need and the joint interest of the various multilateral environmental agreements in this area led UNEP to create the Green Customs Initiative, a pioneering partnership of five convention secretariats and three international organizations¹ that has contributed to the implementation of the Montreal Protocol through its capacity-building activities for customs officers. By supporting this effort to train customs officers in developing countries, the Multilateral Fund has enabled the Montreal Protocol to play a key part in this cooperative effort, which has had the added benefit of increasing the visibility of the Montreal Protocol among customs services and promoting operational cooperation with other multilateral environmental agreements.

The initiative also helped introduce the ozone issue into the sustainable development arena and into debates on security, and offers a coordinated approach to building the capacity of customs officers to monitor trade in commodities of environmental concern. It has always included the monitoring of ozone-depleting substances as one of its objectives. The initiative has included provision of joint customs training focused on awareness-raising involving the various secretariats and organizations; the development of a training guide for capacity-building; the establishment of a website (www.greencustoms.org); and the conduct of national pilot projects.

The first train-the-trainer regional workshop under the initiative was held at the Shanghai Customs College in China in May 2007. The contributions of two individuals should be specifically recognized: Ms. Donata Rugarabamu (Basel Convention secretariat – Officer in Charge and Senior Legal Officer) and Mr. Stephen Nash (CITES secretariat – Chief, Capacity-building Unit). Both have been instrumental in the successful drafting of the Green Customs Training Guide and have brought their exceptional knowledge of multilateral environmental agreements and of customs to bear for the benefit of the GCI partnership.

² In addition to the Montreal Protocol, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants; also, the Convention on Biological Diversity and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The organizations involved are Interpol, the Organisation for the Prohibition of Chemical Weapons (OPCW) and the World Customs Organization (WCO).

Thai Chiller Project. World Bank

Chillers are large-building air-conditioning units, and they have traditionally relied on chlorofluorocarbons (CFCs) for their working fluid and cooling effect. Since the Montreal Protocol was negotiated, chiller manufacturers have made great strides in increasing the energy efficiency of their products. As a result, in many cases, firms replacing old CFC chillers with new ones using CFC alternatives could be expected to save enough money during the first few years of operation to pay for the new chillers. Because the Multilateral Fund covers only the “incremental cost” of conversion, however, and because the determination of incremental cost can take into account the cost savings in terms of energy, chiller replacements have generally not been funded by Multilateral Fund. Despite the energy-efficiency benefits and related potential cost savings, many firms do not have and cannot obtain the capital needed to purchase new, more energy-efficient chillers. Accordingly, the replacement of CFC-based chillers represents a challenge for developing countries.

The Thai chiller replacement project sought to address the funding issue in a very innovative way. As chiller replacement brings about two global benefits – direct elimination of CFCs and indirect reduction of carbon emissions through increased energy efficiency – the World Bank, working with the Department of Industrial Works in Thailand, sought to mobilize resources from both the Multilateral Fund and the Global Environment Facility to capitalize a loan facility for building owners that would demonstrate the benefits of chiller replacement. The project was the first under the Fund to provide financial assistance in the form of concessional loans.

Under the project, the amount of the concessional loan given to each building owner was carefully calculated in order to overcome perceived risks and barriers to early implementation of these energy-efficient conversions. With combined funding of \$5 million from the Multilateral Fund and the Global Environment Facility plus the equivalent of over \$200,000 from the Thailand Energy Conservation Fund, the demonstration project was carried out successfully and resulted in a transformation of the chiller market in Thailand. The latest report provided by the Thai Government indicates that about 700 CFC chillers have now been replaced. Although this complex project took much longer to implement than originally anticipated, it also achieved greater reductions than originally anticipated, ensured payback of the funds involved and gave rise to Government-wide collaboration that led to higher visibility for the ozone issue throughout the country.

Refrigeration and Air-Conditioning End-User Incentive Projects: Ghana, Georgia and Costa Rica.

UNDP

In an effort to help effect a more strategic approach to the phase-out of CFCs from refrigeration equipment, UNDP, in partnership with a number of countries, pioneered the end-user financial incentive project concept. This approach, incorporated into refrigerant management activities, seeks to provide owners of CFC-based refrigeration equipment with a percentage of the funding necessary to retrofit or convert their facilities to ozone-friendly alternatives. The end-user incentive project was initially implemented as a pilot project in two countries, Ghana and Georgia, in order to gain experience and determine whether it would better enable end users in the important refrigeration and air conditioning servicing sector. In each of the pilot projects, the end-user incentive methodology was carefully engineered to deal with sectoral circumstances. The end-user incentive modality has resulted in many useful lessons and has been positively evaluated. As a result, it has been expanded to other countries, including Costa Rica.

Ghana

In the case of Ghana, the phase-out 4.0 ODP tonnes of CFCs per year was sought under the project. To date, a total of 37 companies have taken advantage of the project, resulting in the phase-out of 3.7 ODP tonnes of CFCs, a 93.6 per cent success rate. In order to launch the project and build interest among stakeholders, a targeted awareness-raising programme was initiated by the National Ozone Unit that involved the organization of technical seminars and dissemination of information. Applications from interested enterprises were quality reviewed by a national technical review committee, of which the National Ozone Unit was a member, and further evaluated by an international technical expert.

An initial 40 per cent instalment was released to each approved beneficiary upon signature of a bank guarantee agreement by the National Ozone Unit on behalf of Ghana's Environmental Protection Agency, the UNDP Ghana office, the beneficiary and the relevant banking institutions. The introduction of bank guarantee agreements raised the confidence of the beneficiaries that financing to complete the conversion would be available. Upon inspection of the conversion and retrieval of CFC-using components to ensure their proper destruction, recommendations were made to UNDP to proceed with release of the final 60 per cent instalments.

Through ongoing outreach efforts, the National Ozone Unit continues to encourage the application of best refrigeration management practices among end users. Implementation of the end-user incentive programme has allowed Ghana to adopt ozone-friendly alternatives in a sustainable manner and has placed the country in good stead for compliance with the Protocol's CFC phase-out provisions.

Georgia

The project in Georgia, also part of the pilot exercise to test the innovative end-user incentive concept, focused on end users in the commercial, industrial and transport refrigeration subsectors. The programme was designed to encourage Georgian enterprises in those sectors to replace or permanently retrofit existing refrigeration equipment with cooling systems using non-ozone-depleting substances or a refrigerant with lower ozone-depleting potential and thereby help the country comply with the Protocol's 50 per cent phase-out target. The project aim was to eliminate 5 ODP tonnes of ozone-depleting substances per year, including 1.5 ODP tonnes through direct phase-out. It was also expected to have an important indirect phase-out effect, estimated at 3.5 ODP tonnes, resulting from the awareness-raising component. Under the project, the selected enterprises would receive an incentive payment to replace or permanently retrofit existing refrigeration equipment using non-ozone-depleting substances or a refrigerant with lower ozone-depleting potential.

The project brought together the National Ozone Unit of the Ministry of the Environment and Natural Resources Protection of Georgia, the State Technical University, commercial and industrial refrigeration sector end users, representatives of non-governmental organizations and members of the Georgian Refrigeration Association. The programme concept was introduced to national stakeholders during a workshop that sought to raise general awareness about the importance of phasing out CFCs and helped stakeholders identify appropriate alternatives to CFCs in the commercial and industrial refrigeration end user sector. Upon completion of the theoretical programme, 15 enterprises received assistance under the project to convert their systems from ozone-depleting substances to alternative refrigerants. This resulted in the phase-out of 3,357 kg of CFC-12 per year.

Based on the success of the 15 company pilot projects, two additional companies retrofitted their installations without financial assistance from the project, leading to an additional phase-out of 2,466 kg of CFC-12 per year.

In cooperation with the Georgian Refrigeration Association, the National Ozone Unit produced a series of promotional information CD-ROMs on a survey of the original refrigeration equipment in all 15 participating enterprises and calculations of the most favourable thermodynamic and economic gains that can result from replacing or retrofitting each type of equipment. The CD-ROMs include detailed accounts of activities undertaken during the conversion processes and the steps taken to destroy the old CFC-using equipment, and feature photo galleries of the equipment replaced or retrofitted.

In terms of sustainability, an independent evaluation of the end-user incentive programmes in Ghana and Georgia conducted in early 2007 found them to have been extremely successful. The end-user incentive programme modality was found to have a multiplying and catalysing effect in stimulating the retrofitting and replacement of CFC-based equipment in the commercial refrigeration sector, thus greatly facilitating achievement of the 2005 and 2007 CFC phase-out targets of the Montreal Protocol in the two countries.

Costa Rica

The end user project in Costa Rica is unique in that it targets a specialized economic sector: the fisheries industry. In 2003, CFC consumption in Costa Rica was heavily influenced by the fisheries sector in the Port of Puntarenas. Even though only 5 per cent of the installed refrigeration capacity was in that sector, it accounted for over 50 per cent of total CFC consumption in the country. Based on the success of implementation of the end-user incentive modality in other countries, the Government and stakeholders decided to include such an incentive programme in the Costa Rica refrigerant management plan update to reduce CFC consumption in the fisheries sector.

The fisheries sector in the Port of Puntarenas was characterized by very poor refrigeration practices. It was not unusual for substantial amounts of CFC-12 to be charged into the vessels' cooling systems before each fishing trip, and in some cases by the time the vessel returned to shore all the refrigerant had leaked out. On some vessels, the estimated annual consumption of CFC-12 was six times the initial charge of the system, and in many cases the owners of the vessels were not aware of the impact that the bad management of their refrigeration systems was having on their wallets and on the ozone layer.

The refrigerant management plan update and in particular the incentive programme's conversion process have been catalytic factors in stimulating the refrigeration servicing industry in Puntarenas. During the project's pilot phase, three vessels were converted, with grants of 50 per cent of the associated costs. The benefits of the conversions were immediately evident to the owners and additional vessel owners signed up to benefit from the incentive programme. During 2006, 14 additional vessels were converted and by early 2007 an additional 20 had signed up to take part in the final phase of the programme.

To date, the results have been very promising and owner satisfaction is high. In many cases, the cost of operating the vessels' cooling systems has dropped significantly and the payback time has been under one year. In addition, several steps have been taken to make the cooling systems less vulnerable and better adapted to conditions at sea. The conversion of the cooling systems in the first 17 vessels has resulted in a significant CFC-12 consumption reduction, estimated at 6.4 tonnes of CFC-12 per year, while the cost-efficiency of the incentives given to the owners of the vessels is close to \$10.50/kg. In addition, the project has generated greater awareness of the importance of improving servicing practices and maintaining refrigeration and cooling equipment in good condition. Indirectly, this has reduced the consumption of CFCs in vessels which did not participate in the incentive programme. The incentive programme in the fisheries sector has been an important part of the refrigerant management plan update in Costa Rica, and it would have been very difficult to achieve the 2007 85 per cent reduction without such a well-targeted and successful programme.

Philippines Umbrella Project in the Specialty Solvent Formulations Sector. UNDP

This project highlights the success that can result from international cooperation. In an extremely competitive marketplace, where the suppliers carefully guard their product formulations, five Philippine enterprises which formulated specialty products using ozone-depleting substances voluntarily agreed to revise their product portfolios to substitute new, more ozone-friendly but more costly formulations. Their commitment extended to convincing their end-user customers to adopt these new, more expensive formulations and then working with those customers to help them convert to the new formulations, addressing novel or difficult issues as they arose.

Assisting them in developing their new product formulations was a United States company that had already phased out ODS in its formulations. That company, Tech Spray (Amarillo, Texas) volunteered to share its technology at no cost for the technology transfer. Further, at no expense to the Multilateral Fund, it provided training for each of the enterprises, reviewed the applications contained within each of the enterprises' proprietary product portfolios, suggested a number of new ODS-free formulations to test, and assisted in revising the formulations if the end users experienced unexpected consequences.

This programme resulted from the efforts of the Department of the Environment and Natural Resources (DENR) of the Philippines and UNDP Manila, which saw the need to assist small and medium-sized enterprises in the Philippine effort to phase out ODS. They worked together to identify this specialty formulation subsector within the solvents industry, then to identify those enterprises engaged in that subsector, and then to enlist the voluntary commitment of some of the enterprises. The five enterprises which came forward volunteered to take the risk of converting to the generally more expensive formulations while some of their competitors were still using ODS, and consequently they faced a threat to their market share. This was a significant effort, yielding significant results. A total of 50 tonnes of ODS use per year was eliminated as a result of this programme.

Malaysia Methyl Chloroform Conversion at Proton Automobiles. UNDP

Methyl chloroform (1,1,1-trichloroethane (TCA)) has traditionally been used as a solvent in the cleaning of metal parts. At Proton, a national car manufacturer in Malaysia, the manufacturing production line included a large, conveyORIZED cleaning process that relied on TCA to perform a critical cleaning step during automobile bumper production. This process required zero-defect, precision cleaning since the slightest particle, oil spot or fingerprint left on the surface of the bumper could cause very visible, costly surface defects on the high-gloss, painted bumpers of the Proton cars.

Working with UNDP, the project stakeholders agreed to convert to the use of a water-caustic cleaning process technology. New equipment was needed for the conversion, and additional time for washing and drying steps had to be factored into the process. In order to achieve conversion away from TCA use and not lose production capacity, the bumper conveyor had to be increased in length, the height of the cleaning machine had to be increased to accommodate the new blowers and ventilation equipment, and also the many pumping and recycling lines which the alternative production method required.

The Proton engineering staff was large and competent. They were keen to increase the capacity of local equipment makers and wanted to involve Malaysian contractors during the project's implementation. In order to select the appropriate local partner, the project team at Proton worked closely with UNDP experts to evaluate capabilities, bids, equipment designs, drawings and specifications. Combat Engineering Company, a local company, was selected, and the staff of both companies worked in partnership on every phase of the project to deliver quality results.

The results were indeed very positive: smooth installation, good start-up, prompt correction of so-called "punch list" items and high-quality precision cleaning, thanks to the largest cleaning machine ever installed under the auspices of the Multilateral Fund. The project was completed eight months ahead of schedule and under budget, with savings of \$59,000 returned to the Multilateral Fund, and achieved a phase-out of 195 metric tonnes per year of ODS. Proton engineers and managers invested in providing the support necessary to ensure ongoing capacity-building, which Proton believes will help the indigenous workforce and serve Malaysia well in the future.

China Compressor Conversion at Jiaxipera. UNIDO

Compressors are primary components of refrigerators which drive the process of heat removal. Although by themselves they do not contain CFCs, the conversion of compressor manufacturers was an essential component of the phase-out of CFCs used in refrigerators.

The Jiaxipera company employs 900 staff in the production of six different compressor models used in domestic refrigerators. In 1994, the last year before the project was formulated, the annual production of compressors amounted to 600,000 units, accounting for 10 per cent of the market in China. There were no exports. As the producer of high quality refrigeration compressors, Jiaxipera followed the demand of their main customers, i.e., manufacturers of advanced refrigerators, who understood the strong marketing potential of fully environmentally benign and energy-efficient products. The company, following advice from UNIDO, redesigned their compressor products to accommodate isobutane as the new refrigerant, replacing CFC-12.

UNIDO enabled Jiaxipera engineers to be fully trained in redesign techniques. Thus, with the assistance of an Italian consulting firm, Jiaxipera engineers reduced noise and vibration and improved the efficiency of the compressors through design modifications to several compressor parts. The resulting products met the latest customer requirements and international standards. Jiaxipera is one of the first companies in a developing country to produce the latest environmentally friendly hydrocarbon compressors, phasing out approximately 200 metric tonnes of CFCs per year in the process. The project enabled Jiaxipera to establish long-term, mutually beneficial strategic partnerships with its major customers, offering them a reliable core component supply and establishing a stable market for itself. Since Jiaxipera could easily find isobutane compressor users both in the local and in export markets, its sales increased. By 2000, Jiaxipera was already producing 1 million compressors annually, and by 2007, its production had increased to over 4 million units a year.

China Refrigerator Conversion at Zhejiang Huari. UNIDO

The Zhejiang Huari group employs 720 staff to manufacture some 40 refrigerator/freezer models, the main product being high-end household refrigerators with fuzzy electronic controls. When its Multilateral Fund project was formulated in 1995, the company was producing around 312,000 units a year, 4 per cent of the Chinese market. There were almost no exports. The group understood the strong marketing potential of fully environmentally benign and energy-efficient products. Thus, heeding technical advice from UNIDO, the company pioneered the application of long-term hydrocarbon alternatives: CFC-11 was replaced by cyclopentane as the foam blowing agent and CFC-12 was substituted by isobutane as the refrigerant.

The group seized the conversion opportunity to upgrade the manufacturing premises and to rationalize the manufacturing process. It consolidated four assembly lines into two and invested heavily in a new building in an industrial zone, designing around the requirements of the new technologies. All new equipment and the complete manufacturing line were inspected and their conformity with the latest industrial safety standards was certified by TÜV Germany. The first batch of appliances was redesigned with the assistance of German experts, who trained Huari engineers so that they could redesign and finalize conversion of the remaining models on their own and have them certified. The basic manufacturing equipment came from Denmark, Italy and Germany.

The Zhejiang Huari group was one of the first companies outside Europe to apply cutting-edge hydrocarbon refrigeration technologies. Through this, the group was able to phase out 338 tonnes of CFC per year, increase its production and raise its labour productivity by 30 per cent. Exports in the first few years after project completion increased from \$50,000 to \$2,000,000 and the company is now manufacturing most of its products for a major multinational company. In addition, working conditions and occupational health and safety were also improved. Long-term employment of the company's staff through better business opportunities and human resource development was secured in a competitive business climate, despite the extensive industrial consolidation in this sector in China

Romania Refrigerant Management Plan. UNIDO

Of the over 140 developing countries eligible for assistance from the Multilateral Fund, over half use CFCs exclusively for the servicing and maintenance of existing refrigeration equipment, and most of the rest use significant quantities for this purpose. In order to reduce this use in a thoughtful manner, the Multilateral Fund developed the concept of the Refrigerant Management Plan (RMP). Over time, RMPs evolved to contain certain specific components designed to enable Article 5 countries to deal with this vital sector.

Prior to Romania's RMP, that country used 433 tonnes of CFCs a year for servicing and maintenance of refrigeration and air conditioning equipment. In order to ensure the country's continued compliance with its Montreal Protocol obligations, the Government requested UNIDO to prepare an RMP that would reduce that consumption. UNIDO designed the RMP around a refrigeration training centre that had been built earlier with UNIDO-implemented Austrian bilateral assistance. The Plan's aim was to provide Romania's 310 licensed refrigeration service workshops with updated service technology, adequate service equipment (including CFC recovery machines) and information on alternative refrigerant technology.

The project has resulted in the reduction of a significant proportion of the CFC consumption for servicing and maintenance of refrigeration equipment. The training component of the projects helped train service technicians at around 300 workshops and has resulted in the sustained use of best servicing practices and the effective utilization of the new equipment. As a result of the project, there are fewer leaks from installations. In addition, CFCs are now recovered through a country-wide system for recovery and recycling, and that system in turn provides local industry with an opportunity both for recycling and for producing the refrigerant recovery systems needed.

Through an additional component of the RMP, customs officers were trained at workshops with European Community experts and equipped with refrigerant identifiers. They are now empowered to carry out customs checks for CFCs and CFC-containing equipment. As a result of this project, environmental impact, working conditions and occupational health and safety in all recipient service workshops have improved. In addition, long-term employment of service technicians has been secured at a time when refrigerant technology was changing.

Jamaica Refrigerant Management Plan (RMP) and Terminal Phase-out Management Plan (TPMP). Environment Canada; UNEP (for RMP), UNDP (for TPMP)

By the end of the 1990s, CFC consumption in Jamaica was confined to the servicing of existing refrigeration and air conditioning equipment. The Government set itself an ambitious goal: to eliminate this CFC consumption completely by 31 December 2005, four years ahead of the phase-out schedule applicable to developing countries under the Montreal Protocol. This RMP project, implemented between 1999 and 2002, and the 2002–2006 work on the TPMP, which built on the achievements of the RMP, were the key projects approved under the Multilateral Fund to assist Jamaica in meeting its target of accelerated CFC phase-out.

The RMP and the TPMP that followed transferred the expertise and technology required, both to reduce reliance on the use of CFCs in servicing refrigeration and air conditioning equipment and to facilitate the enforcement of the CFC import controls instituted by the Jamaican Government. Specifically, under the projects most of the country's refrigeration technicians were trained in best practices; a code of practice for technicians was developed and made mandatory; CFC recovery and recycling machines were provided to as many technicians as possible; several CFC users who were not able or willing to convert their systems to alternatives on their own were provided with financial incentives to do so; and the safe use and handling of hydrocarbon refrigerants as CFC alternatives were introduced. The particular expertise developed in Jamaica with hydrocarbon refrigerants is now being shared with other countries in the English-speaking Caribbean region.

This project also saw the development and implementation of the first comprehensive training programme for customs officers, based on a draft training manual that had been developed by UNEP, with assistance from Canada and Finland. The experience with the customs officers' train-the-trainers workshop in Jamaica provided essential information for refining the format and content of the training programme and finalizing the UNEP training manual for customs officers. These resources were then widely used and applied for the training of customs officers in most of the other Article 5 countries. Such training programmes have been key to ensuring that customs officers have the awareness, knowledge and skills necessary to implement the ODS import licensing systems which ensure countries' compliance with their obligations under the Montreal Protocol.

The efforts of the Jamaican Government and industry stakeholders themselves were fundamental in ensuring that the country did ultimately meet its target of early phase-out and thus became the first country in Latin America and the Caribbean to eliminate CFC consumption completely. From the beginning of Jamaica's country programme for the phase-out of ozone-depleting substances, the National Ozone Unit provided continuous and tireless leadership to promote the objectives of the Montreal Protocol and forged excellent relationships with key stakeholders in the refrigeration and air conditioning industry.

In this regard, the efforts of the National Ozone Unit, and in particular Ms. Veronica Alleyne, during the implementation of both the RMP and TPMP are particularly noteworthy. In addition, the Government set the framework for CFC phase-out by adopting clear and ambitious regulations (eventually grouped under an Ozone Act) and established a national ozone commission that was also instrumental in providing guidance and ensuring development and implementation of all projects. Lastly, the association of refrigeration and air conditioning technicians played a decisive role in encouraging CFC users to switch early to alternatives and implement best refrigeration practices.

The total cost of the RMP and the TPMP that made the total phase-out possible amounted to approximately \$485,000. The project has achieved its ultimate goals, as Jamaica completely eliminated CFC consumption as of 31 December 2005. The resources, equipment and training skills provided under the RMP and TPMP are now being used to address other refrigerants as the principal technical institutes have incorporated training in best practices within their curricula for training refrigeration and air conditioning technicians.

Conversion of 11 Small and Medium-Sized Commercial Refrigeration Enterprises in Malaysia.

UNDP

The commercial refrigeration sector includes the production of such things as chest freezers, bottle coolers and display cabinets as well as the larger display cases which one may see in the more modern grocery retailer's. In many countries, the commercial refrigeration sector includes a number of small and medium-sized enterprises (SMEs), and as in the case of most sectors addressed through the Montreal Protocol, these SMEs tend to face unique challenges in phasing out ODS.

The project, approved in December 2000, sought to address the over 60 ODP tonnes of CFC-11 and CFC-12 that were used each year in the production of commercial refrigeration equipment at 11 SMEs located in four regions of Malaysia. These enterprises produced between 2,400 and 4,500 commercial refrigerators annually. In order to achieve the move away from CFC use in a cost-effective manner, UNDP worked with the enterprises to adapt their product mixes to the capacities and capabilities of the bulk-procured, standardized replacement technology and equipment provided to them under the project. In the process, the firms rationalized their product mixes to enable them to concentrate on improving the quality of their products. Most of the enterprises reinvested the incremental operating costs funded through the project in order to procure additional plant and machinery which in turn helped enhance the quality of their products and lower costs through efficiencies and reduced wastage, and led to more competitive market positioning. Despite the geographic spread of the SMEs and the implementation challenge which their distances from each other presented, the project was completed ahead of schedule.

Pakistan Conversion from CFC-11 in the Manufacture of PVC-Foam Shoe Soles.

World Bank

In some instances, the soles of shoes were made from PVC foam using CFC-11 as the blowing agent. In the case of this project, the firm in question also used CFC-11 as solvent for painting. Like many projects under the Multilateral Fund, this project has a long history. The original project concept, which was submitted in September 1999, foresaw replacement of CFCs by butyl acetate in the paint operation and other blowing agents for PVC foam extrusion at a cost of \$753,500. The Fund Secretariat's review, however, raised issues that precluded it from moving forward at that time. It was subsequently reconfigured and resubmitted, based on conversion to butyl acetate at a cost of \$325,000, but questions regarding the eligibility of the project under the rules of the Multilateral Fund resulted in the total grant amounting instead to \$175,000, for technical assistance towards a solution to phasing out the use of CFCs. This was accepted by the enterprise and the project was approved by the Executive Committee of the Multilateral Fund as part of Pakistan's foam sector phase-out project in December 2003. Over the course of the next year, the firm carried out an in-depth technical re-evaluation of all options and developed a proposal to convert its operations to air injection for higher density models, and to ethylene vinyl acetate (EVA) foam for lower-density models. The company would carry out the conversion to air injection by itself and share the cost of EVA extrusion and moulding equipment based on expected cost savings. The change in technology was so successful that the company used its own funds to purchase a second extruder even before the project closed. It turned out that EVA was easily accepted by the market and that its higher price was compensated by this market preference as well by a much lower product weight.

This project presented many challenges, not least of which was the fact that it was a new application which had never before been reviewed under the Fund. Nevertheless, the backers of the project persevered and in the end, even the delay which occurred as a result of new technical developments did not work to the disadvantage of the enterprise.

Another challenge was the choice of technology. The use of CFCs was seasonal and related to the cold winters in Rawalpindi. The only option that would not include a considerable technological upgrade would have been climate control for the plant, an option on which the project costs were based but carried large incremental energy costs. The willingness of the company to share substantially – more than the amount of the grant – in the cost and to make a technology leap that exceeded even the experts' visions ultimately solved the issue.

The total project costs were budgeted at \$325,000, of which \$175,000 was to be paid by the Multilateral Fund and \$150,000 by the enterprise. At the closing of the project and the complete elimination of 45 tonnes of CFC-11, \$165,000 of the grant and \$80,000 in company funds had been used. The company was still investing, however, in additional moulding and extrusion equipment.

Project sustainability is assisted by the fact that the quota system in Pakistan will not allow industry to use CFCs in the future. In addition, the market acceptance and cost-effectiveness of the new technology is such that the company would never consider returning to its old technology. Also, the new technology has an added benefit: it is not only ODS-free but is also much lower in global warming potential. Although the company was discouraged by the long approval process, it is excited about the final outcome.

Conversion of Kulthorn Kirby Compressor (KKC). World Bank

KKC is a Thai-Australian joint venture established in Bangkok in 1980 which produces hermetic compressors for refrigerators, water coolers, air conditioners and pump kits. The company works under license from Tecumseh Products, USA. KKC is a leader in compressor manufacturing in Thailand, with a current local market share of around 54 per cent and exports amounting to 35 per cent of production.

The Multilateral Fund approved a project to cover the incremental costs of equipment, technology transfer and training necessary to facilitate conversion from CFC-12 to HFC-134a for compressor manufacturing. In all, this provided \$1,294,021 of the \$3,282,000 that would be needed for the conversion of manufacturing from CFC-12 to HFC-134a.

Like many projects, this project proceeded in a phased manner. Phase I of the project involved, among other things, assembling 100 HFC-134a compressors using imported parts provided by Tecumseh, followed by manufacturing nine different models of compressor (740 units) in existing KKC facilities. Phase II involved the full conversion of KKC's plant.

The exemplary nature of this project, beyond the technological conversion of the company, results from the efforts required to market the new technology to the company's clients. Initial problems were encountered during the execution of Phase I as HFC-134a test compressors were demonstrated to KKC's clients, of which a large majority were subsidiaries of Japanese firms. Although product standards were in compliance with those developed by Tecumseh, USA, they did not meet Japanese standards. The Japanese firms designated the Japanese Electrical Manufacturers' Association as their representative in the negotiations with KKC and Tecumseh, which were prolonged. Ultimately, the design specifications were modified to take into account Japanese standards, after which the new models were accepted by all parties and full-scale compressor production started.

India Foam Sector Umbrella Project for Conversion to CFC-free Technology. UNDP

In the mid-1990s, many countries had small and medium-sized enterprises (SMEs) that were using CFCs to make foams. These SMEs were usually characterized by very low levels of investment in plant and machinery.

In 1997, UNDP and the Ministry of Environment and Forests of India developed a group project to convert 80-SMEs in the foam sector which employed a total of about 2,000 people. The enterprises were using 290 tonnes of CFC-11 a year to manufacture rigid polyurethane foam insulation products for purposes such as thermal insulation in buildings and insulated household appliances (thermoware) such as jugs, flasks, hot/cool cases and so on, used to keep food and beverages appropriately hot or cold.

Although general awareness about quality assurance, training, and environment and safety-related issues existed in these firms, it was not emphasized in practice. As a result, they did not have a very good ability to keep costs down, and this, combined with their limited operating capital and their small scale of operation, led them to be weak competitors in a crowded domestic market that was also experiencing an influx of cheap imports. In general, knowledge of the latest chemicals and technologies was quite limited in these enterprises. In addition, these SMEs lacked the technical and managerial capacity to follow sound procurement practices.

To address the needs of these SMEs, UNDP developed customized low-cost, low-output foaming equipment in collaboration with suppliers, including an indigenous chemical supplier which designed the required CFC-free chemical formulations to enable the SMEs to use the new environmentally friendly technology cost-effectively. The equipment was designed for easy, economic and efficient operation and maintenance to ensure long-term sustainability. Further economies in project costs were achieved through standardization, bulk procurement and indigenization. Extensive technical assistance and training inputs were provided to enhance the capacity of the SMEs to address technical and environmental issues. The project was successfully completed in 2000. Replicating this success, three similar projects were developed and implemented during 1999–2003 in this sector, covering an additional 70 SMEs and employing another 1,500 or so people.

Through these and other projects, UNDP came to understand that the key determinant of the success of such projects is ensuring the economic availability and sustainability of the appropriate environmentally friendly technology, including environmentally friendly raw materials. This in turn ensures commitment on the part of the SMEs to incorporating environmental objectives into their investment and operational decisions. Through innovative approaches in project execution, such as bulk procurement for achieving economies of scale and enhancing local capacity and indigenization through extensive technical assistance and training, it is possible to achieve the cost-effective and sustainable introduction of environmentally friendly technologies in SMEs and to enhance their long-term viability.

Argentina Foam Sector Conversion of Small and Medium-Sized Enterprises. UNDP

In the early years of the operation of the Multilateral Fund, agencies and countries tended to work on a project-by-project basis. Over time, the mode of operation changed to a more efficient sector-by-sector or national phase-out modality. When most of the enterprises in a sector had already phased out ODS using the project-by-project modality, countries and agencies often moved to what is known as a terminal phase-out approach, in which all the remaining enterprises in a sector, or, indeed, in the entire country, would be covered under one project.

The Argentine terminal foams sector phase-out project sought to identify all remaining CFC-based foam users and phase out the residual consumption of CFCs in that sector at the national level. The project conducted a survey that produced a very complete database of foam users in the country which, in the long term, would help Argentina to monitor compliance.

A total of 162 mostly very small enterprises that were still using CFCs to make foams were identified. The size and lack of sophistication of the companies, however, made verification of eligibility and CFC use difficult. The usual procedure – reliance on supplier data – did not work in this very large but sparsely populated country. Ultimately, it was determined that 77 of the 162 companies were eligible and interested in participating in the project. Annual consumption in the eligible enterprises amounted to 195 tonnes of CFCs. Those 85 companies that did not participate were either only recently established (making them ineligible for Fund assistance), not interested in assistance, already in possession of non-CFC-using equipment, or were too small to qualify for investment assistance.

The project conducted an exhaustive procurement exercise that included validation of untested local suppliers and adjustment of specifications to reflect what was generally the tiny size of the operations that needed to be converted. While this worked very well, and cut costs per machine to a very low level, the level of funding approved within the existing guidelines (\$1.3 million) nevertheless posed implementation challenges given the sheer number of firms covered by the project. In the end, innovative procurement procedures, low trial costs and restriction of payments to operating costs allowed all eligible companies to be provided with suitable equipment. Recipients indicated that they were very satisfied with the support provided.

The project resulted in the direct phase out of the 195 tonnes per year of CFCs as projected, and indirect phase-out of an additional 58 tonnes per year of CFCs as a result of non-eligible companies phasing out CFC uses on their own thanks to the dissemination of the project's achievements and technical information. In terms of long-term phase-out sustainability, the price of CFCs has increased in Argentina and is now over twice that of the replacement chemicals used, and no return to CFCs is feared. In addition, the Government is monitoring compliance very closely.

Non-Investment Training Programme for Terminal Phase-Out of Methyl Bromide Use in Ghana, Excluding Quarantine and Preshipment Applications. UNDP

This non-investment training programme for terminal phase-out of methyl bromide approved for Ghana targeted elimination of ODS use in the melon production sector. The project is exemplary because, in a sector where the modus operandi is “seeing is believing”, where demonstration and pilot projects are encouraged to build the confidence of growers before other activities may ensue, Ghana began by tackling the policy aspects of sustainable phase-out.

It established a national, multi-stakeholder methyl bromide technical committee (MBTC) whose first order of business involved updating the country’s ODS legislation to conform with the targeted elimination of methyl bromide use by 2005. The MBTC, through extensive national and regional technical consultation, adopted a national methyl bromide action plan to ensure a transition to the use of alternatives that would preclude the reintroduction of methyl bromide use for non-quarantine and preshipment uses after phase-out.

By 2003, the legislation was in place. The MBTC, which had taken on the responsibility for implementation and monitoring of activities, then initiated a series of field trials including the use of organic soil amendments, solarization and fungicides. Over the course of the next two growing seasons, the MBTC oversaw technical and training activities in the principal Galia melon production areas. Testing followed by validation of results on both small-scale and large farms ensued.

In 2006, with positive results to show, the MBTC organized a farmers’ field school to introduce the alternative techniques for controlling soil-borne pathogens to all farmers, and also to agricultural extension officers, to empower and encourage them to use these methods over the long term. Participants were trained in the various means of application using the various methods, and also in safe ways to handle pesticides. This work was carried out by resource persons from the Plant Protection and Regulatory Services Department and Department of Crop Science of the Ministry of Food and Agriculture, and the University of Ghana. Farmers were also trained in methods of data collection, ecosystem analysis and the impact of the use of alternatives, and in how to evaluate the effectiveness of the improved methods against their traditional farmers’ practices.

Although this approach is not suitable for all countries, the Ghanaian example shows that through strong cooperation, strict controls accompanied by rigorous technical analysis can yield success. Ghana has remained methyl-bromide-free for non-quarantine and preshipment uses since it signed on to its Multilateral Fund project.

India Process Agent Project at Satya Deeptha Pharmaceuticals Ltd., Humnabad. UNIDO

Process agents are chemicals that act as catalysts for the chemical reactions needed to produce a host of modern products and chemicals. Traditionally, there has been a small group of ozone-depleting substances which have been used as process agents in both developed and developing countries, and their use in developing countries has often been associated with high emission levels. The question of the control of process agents under the Montreal Protocol had been unclear until 1998, when the Parties decided on a framework for their treatment in developing countries. Since that time, the Multilateral Fund has gained significant experience with such projects.

This process agent project was approved by the Executive Committee at its thirty-second meeting, in July 2000, with a project budget was \$260,133. The project phased out the use of 25.38 metric tonnes (27.92 ODP tonnes) a year of carbon tetrachloride at Satya Deeptha Pharmaceuticals Ltd., Humnabad. It had been used as process solvent in Ibuprofen production. Carbon tetrachloride was replaced with ethylene dichloride (EDC) without any increase in production capacity.

Satya Deeptha Pharmaceuticals Ltd., Hyderabad, produces Ibuprofen. The company has its manufacturing activity in Humnabad, Karnataka state. The company started production of Ibuprofen in December 1994. The company has 100 per cent Indian equity participation and installed capacity for Ibuprofen production was 323 tonnes per year. Carbon tetrachloride was used as process solvent in the first step of Ibuprofen production only. The historic amount of carbon tetrachloride involved in the process between 1997 and 1999 (27.92 ODP tonnes a year) was used as the baseline for assessing costs in the project.

The company eliminated its consumption of carbon tetrachloride by converting to the use of the non-ozone-depleting solvent ethylene dichloride (EDC) in its manufacture of Ibuprofen. Ibuprofen capacity was maintained at 323 tonnes a year by the proposed investment. The properties of the new process agent EDC were very similar to those of carbon tetrachloride and it proved to be the best choice of replacement. The project did encounter some technical difficulties, however, in using EDC, involving such factors as toxicity, volatility and flammability. As a result, the storage site had to be located away from the production area and covered. In the end, the ODS phase-out had been implemented successfully by January 2003 and the conversion technology and equipment proposed were found to be adequate for the changeover from carbon tetrachloride to EDC.

Guide for National Ozone Officers. UNEP

To date, the Multilateral Fund has supported the establishment of national ozone units in over 140 countries. Among the goals of related projects are the hiring of at least one full-time individual to enable each country to focus specifically on ozone issues. This individual is most commonly referred to as the National Ozone Officer. National ozone officers are very important individuals who are responsible for advancing the phase-out of ozone-depleting substances in their countries. In that role, they often help prepare regulations or legislation, and help facilitate the development and implementation of projects.

Over time, it became clear that there was a significant turnover in national ozone officers, and that the learning curve for new officers was very high. In an effort to address this, UNEP developed a Guide for National Ozone Officers that was designed to serve as a quick reference tool providing comprehensive knowledge. The Guide was developed using a participatory approach that drew on the experience of many national ozone units. First issued in 2006, it was judged to be a very good and useful tool. It contains the common wisdom of the ozone community and is the only such document to have been developed to help officers carry out their obligations under the relevant multilateral environmental agreements.

China Online Training System. China State Environmental Protection Administration (SEPA) and UNEP

When the Multilateral Fund approved a unique enforcement project for China, it was uncertain how the country would go about training the thousands of local and national authority officials who would be needed to ensure compliance with the Protocol. After due consideration, SEPA developed and initiated an innovative online training system as a supplement to the traditional face-to-face workshop training. The approach is being implemented by UNEP.

The online training system consists of a long-distance e-learning system that is based on web and multimedia information technology including animation, videos and audio materials. This one-of-a-kind project was designed with a general training module that would target general local officials other than customs officers, and another module targeting customs officers specifically. It also includes a database of policies and regulations related to ozone-layer protection.

The integrated national online training programme has been operative since it was launched at the 2005 International Ozone Day Celebration. About 2,000 local officials from 12 provinces and cities in China have been trained using the system since then. The online system has also helped trainees who received face-to-face training, enabling them to upgrade their knowledge using the online system.

The online system has proven to be a very useful and effective method and tool for local officials to acquire knowledge concerning ozone-depleting substances, which is essential for China to implement its accelerated phase-out plan and maintain compliance after 2010. The online training system delivers training in a more cost-effective way and has become a valuable approach for complementing, communicating and updating information from face-to-face training. SEPA and UNEP have reached agreement with the local information technology company which developed the software to enable it to be used by other countries, and translation into English is ongoing. An extension of the system to provide training on other multilateral environmental agreements is also under consideration. In all, the system has proven to be a unique, innovative approach to promoting capacity-building for local officials and customs officers on environmental issues.

Methyl Bromide Phase-Out in Jordan. Germany (GTZ), UNIDO

The phase-out of methyl bromide under the Multilateral Fund is often a multi-stage activity. In the case of Jordan, the first stage was the approval by the Fund of a project for Jordan's Ministry of the Environment (Ozone Unit) to work with UNIDO on a survey of methyl bromide consumption in the country. The survey found that Jordan's annual consumption of methyl bromide was 385 metric tonnes, and that this use was dispersed over a number of applications.

In order to consider the viability of alternatives for the major applications, in 1997 Jordan submitted to UNIDO and GTZ two demonstration projects to test alternatives. These projects, which were implemented between 1997 and 1999, led Jordan, working with GTZ, to submit and obtain approval of investment projects to phase out methyl bromide use completely in 1999.

To implement the projects effectively and facilitate the phase-out of methyl bromide use in Jordan, the Ministry of Environment organized two committees: a steering committee consisting of the secretaries-general of the Ministry of Environment, the Ministry of Agriculture and the National Centre for Agricultural Research and Technology Transfer, and another consisting of representatives of non-governmental organizations and farmers and for gender issues. Between 2000 and 2007, the project undertook a large number of activities including 700 field demonstrations, in farmers' fields, designed to ensure the effective transfer of the technologies for the selected alternatives (biofumigation, solarization, grafting and direct seeding) ; 400 workshops and field days were held on the farms for training and awareness-raising; training was provided to about 50 trainers who would then go on to train about 1,000 pioneer farmers; seven nurseries were supported technically and assisted with capacity-building; a licensing and quota system was established to control methyl bromide imports and distribution; farmers were encouraged to use alternatives and were provided with extensive technical support to enable their use; awards were given to 150 farmers who phased out the use of methyl bromide; and media materials were also developed to promote the phase-out. Related activities included development of a website, and production of annual reports (2001–2006), a quarterly newspaper, posters, TV programmes and brochures.

The projects have enabled Jordan to phase out 310 tonnes of annual methyl bromide use out of 385 tonnes. In the process, Jordan has found that the quality of the products produced using alternatives to methyl bromide is higher than was achieved in traditional way. The use of alternatives also had another significant benefit: the use of alternatives required only 35 per cent of the water previously needed, a significant factor where water is precious. In addition, the quantity of products produced using the alternatives was greater than that produced using methyl bromide. The use of alternatives has given Jordan the ability to export its products, and the projects have also produced experts with experience in the area of alternatives to methyl bromide.

The experience to date has give Jordan the confidence to plan an accelerated schedule to phase out methyl bromide use still further.

System for Storage and Charging of Ester Oils Used in the Manufacture of HFC-134a Compressors at Embraco, Brazil.

World Bank

Embraco was founded in 1971 to manufacture compressors for the commercial and domestic refrigeration sectors, and has since become one of the world's largest suppliers, with a current production of approximately 9.2 million units per year, 70 per cent of which were exported. Embraco was one of the first companies worldwide to develop HFC-134a compressor designs, which required demanding procedures for materials handling and for quality control because of the relative instability of the ester oils that it used in the process. Early development of significant capacity for production of HFC-134a compressors was required to satisfy the demands of the company's European and American export markets, which were subject to the 1996 ban on CFC use. At the same time, Embraco had to maintain its CFC-12 compressor production capacity to satisfy the demand of other Article 5 countries not subject to the early CFC ban.

Financing from the Multilateral Fund of \$221,000 was obtained for the purchase and installation of an ester oil storage, dehumidification and charging system for use on seven of the company's assembly lines. The new system was needed to lubricate HFC-134a-based compressors, as the mineral oil used in CFC-12-based compressors was incompatible with HFC-134a. Phase I of the project, which covered three assembly lines, was financed on a retroactive basis, while Phase II covered the installation of four additional lines. The project was successful in its goal of indirectly phasing out an annual 338 tonnes of CFC-12 use within a year. In addition, the \$221,000 from the Fund leveraged over \$1.1 million in counterpart funding.

This project was exemplary in that it facilitated the conversion of one of the largest refrigerator compressor manufacturers in the world, and also in that it succeeded in achieving the expected technical standards and the higher efficiencies of compressors produced using ester oils and HFC-134a. Beyond this, the project made it possible for Embraco to operate under a flexible scenario whereby both CFC- and HCF-based compressors were produced at the same time, thereby allowing the company to satisfy and to adapt to the specific market demands of its Article 5 and non-Article 5 clients.

Conversion of Compressor Design for Refrigerators and Appliances from CFC-12 to HFC-134a at Kirloskar Copeland Ltd. of India.

World Bank

Kirloskar Copeland Ltd. (KCL) was established in 1993 as a joint venture between Kirloskar Brothers Ltd. (India) and Copeland Corporation (USA). KCL entered a technology transfer agreement with Copeland Corporation whereby the latter would transfer the necessary technology for manufacturing compressors using HFC-134a and other ozone-friendly refrigerants. Phase I of the project involved engineering development, prototype manufacturing and testing of compressors for HFC-134a, and also customer training in the use of HFC-134a compressors. Phase II consisted in the establishment of manufacturing facilities for HFC-134a. The Multilateral Fund grant for this project amounted to \$530,000 and total costs amounted to \$1,010,526.

The exemplary nature of this project stems from the role played by KCL in the overall conversion of the refrigeration sector in India. KCL was highly successful in converting its production of 17 models of compressor to HFC-134a and in phasing out all products using CFC-12. Uptake of the new compressors was slowed, however, because national restrictions on CFC use for refrigerator manufacture were not put in place until after the company had converted its production line. In an effort to address this problem, KCL, a company with a long-standing reputation, teamed up with the Government in promoting the phase-out of CFCs from the refrigeration sector. By organizing a massive training and technical assistance programme in various locations around the country, KCL was able to reach many of the small and medium-sized enterprises which make up this sector in India and was instrumental in its gradual conversion.

Technology Conversion Financing Programme (TECFIN I & II) in Chile. World Bank

The technology conversion financing programme (TECFIN) in Chile was one of the first projects under the Multilateral Fund to explore alternative approaches to financing the ODS phase-out.

Chile has had a long history and much experience of using market-based approaches and policies to initiate positive environmental change in the private sector. Accordingly, after studying a variety of market-based instruments which could be used to enhance efficiencies in the application of Multilateral Fund funding, in 1995 the Government of Chile and the World Bank submitted the TECFIN project, which proposed to use an auction programme to ensure the most competitive and cost-effective application of funds for efficient phase-out. TECFIN, which would go on to be funded through two additional phases, began with the approval of \$1 million in funding by the Fund's Executive Committee at its nineteenth meeting, in May 1996. With these funds in hand, the first auction programme was initiated.

TECFIN's market-based approach was designed to take advantage of enterprises' superior knowledge and information concerning such things as equipment life, operating costs and policy environments for multinational competitors, and national and international markets. Using this knowledge, enterprises then bid on grants, offering to achieve a given level of reduction in ODS use for a specific amount of money. Funding was then given to the lowest bidders, i.e., those which stated that they would reduce the most ODS at the least cost. The result is a cost-effective and efficient phase-out. The auctions were designed within the framework of a set of transparent and simple cost-effectiveness and administrative controls. These included (1) ensuring that sufficient competition existed within each auction, i.e., that there was a sufficient numbers of firms bidding; and (2) ensuring that competitors in each particular auction had similar cost structures. In addition, and crucially, the Government implemented key policy reforms to ensure that access to ODS would be constrained over time. These legal and policy reforms initially created some delays in project start-up but proved over time to be essential to project success, especially for the later TECFIN II project.

Eleven firms in the domestic and commercial refrigeration and foam sectors participated in the first TECFIN auctions. Close to 120 tonnes of annual ODS use were phased out at a cost-effectiveness of about \$3.59/kg. (\$495,000 was disbursed for the first auction programmes, while the remaining funds supported policy and capacity development and public awareness-raising.) As one would expect, larger firms were able to phase out larger amounts of ODS use and had better cost-effectiveness values, in the order of \$2/kg. Initially, small firms which participated phased out smaller amounts of ODS use and had cost-effectiveness thresholds of close to \$33/kg. Recognition of the higher costs for small enterprises led to an adaptation of the auction programme, whereby a fixed \$30/kg subsidy for these small enterprises was established, which proved to be a strong and effective incentive for small firms to participate.

Building on the success of TECFIN I, and using the lessons learned from its implementation, the Government of Chile and the World Bank developed and obtained approval for TECFIN II, a two-tranche continuation of the auction programme. The lessons learned from TECFIN I clearly enhanced the implementation effectiveness of the programme. Over 20 firms in the refrigeration and foam sectors participated in the subsequent auctions, with a total phase-out of almost 410 tonnes of annual ODS use. The cost-effectiveness under this later project was even better than predicted in the project proposal: only \$5.51/kg against a projected \$9.50/kg. The success of this market-based approach is reflected in the excellent cost-effectiveness of the TECFIN programme as a whole, which compares very well with the Multilateral Fund's cost-effectiveness thresholds for related sectors.

These achievements should be particularly noted for TECFIN I, which showed excellent cost savings compared to other projects implemented relatively early in the life of the Multilateral Fund. TECFIN I and TECFIN II taken together have phased out over 525 tonnes of annual ODS use at a cost of approximately \$3 million to \$3.5 million (depending on whether the non-investment components are included).

TECFIN was a successful project that effectively utilized a market-based approach coupled with targeted policy reforms to create incentives for efficient and cost-effective ODS phase-out. It also paved the way for other innovative projects which were able to adapt the particular instruments used while utilizing the fundamental concept of an approach which builds on private-sector know-how and public-sector policies and incentive-building. This dual market and policy approach has proven to be the key tool for effective and sustainable ODS phase-out, not only in Chile but around the globe

Refrigeration Management Projects in Africa. Germany (GTZ Proklima) and France (Agence Française de Développement)

Since 1998, Germany (GTZ Proklima) has assisted 17 African countries (Angola, Botswana, Ethiopia, Gambia, Kenya, Lesotho, Liberia, Malawi, Mauritius, Mozambique, Namibia, Seychelles, Swaziland, Uganda, United Republic of Tanzania, Zambia and Zimbabwe) in planning and implementing their national refrigerant management plans (RMPs). The focus was on managing and reducing the use of ODS-based refrigerants (CFCs) in the refrigeration and air conditioning sectors.

At the time of the approval of the first RMPs, all 17 countries together consumed over 1,350 tonnes of CFCs a year. Since then consumption has been reduced steadily to approximately 400 tonnes a year, and the Multilateral Fund has approved the second phases (RMP updates) and some third phases (terminal phase-out management plans) to help eliminate the residual consumption. Total funding approved for these projects has amounted to \$4,839,463.

For each country, an individual, needs-based approach was used, with the various stakeholders participating in developing the projects, their activities and their funding modalities. Initially the projects created an institutional framework (i.e., ODS regulations) to control ozone-depleting substances within the countries.

The work on national ODS regulations was then complemented by capacity-building within the customs services, which are in the forefront of enforcing ODS regulations. In Namibia, for example, the Ministry of Finance included ODS in their ASCUYDA++ system, which is the electronic database used by the Namibian customs service at all Namibia's border posts. Existing regional structures such as the Southern African Customs Union (SACU), the Common Market for Eastern and Southern Africa (COMESA) and the Southern African Development Community (SADC) were also used to encourage harmonization of ODS trade.

A key component of the projects has been training of refrigeration service technicians. In this regard, the projects used a "train-the-trainer" approach providing further education to trainers in vocational training centres who in turn provided training to technicians throughout their countries, including in rural areas. This ensured that know-how on alternatives to ODS-based refrigerants also reached those living outside the main cities. Local service workshops were used as training facilities where formal training centres were not available. Some new vocational training centres have since been established, and these too have been supplied with the necessary training equipment to ensure that they are able to offer their students well-equipped training courses.

The projects emphasized the use of South-South cooperation whereby existing local and regional know-how is promoted and exchanged. Trainers from one country conducted training in other countries, bringing with them ideas and practices that could readily be applied. The needs-based approach meant that projects had to be flexible. For example, the authorities in Mauritius wanted to address aspects of the Montreal Protocol together with aspects of the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

Its technicians were therefore trained in the use of long-term environmentally sustainable refrigerants such as hydrocarbons. The project made it possible to conduct the required training in the country.

Another extraordinary aspect of the TPMPs in the cases of Lesotho, Mauritius and Namibia is that although the countries had committed themselves in their agreements with the Executive Committee of the Multilateral Fund to achieve total phase-out in 2008, which is well ahead of the Montreal Protocol's requirements, in 2005 the three countries had already achieved complete phase-out of ODS use, an achievement that is attributable to the dedication shown by their national ozone units to achieving the phase-out in their countries.

With the number and financial volume of projects increasing, many of the countries opted for continued bilateral project implementation. To continue assisting the countries, Germany and France came together to fund and implement several projects together.

An important activity has been an incentive scheme for commercial users of refrigeration and air conditioning systems. The incentive scheme was developed through the participation of stakeholders, i.e., the refrigeration and air conditioning service industry and the owners of cooling equipment. Criteria were established that encouraged owners of commercial cooling equipment to retrofit their existing ODS-based units to alternative technologies. Towards that end, the project covered a percentage of the actual costs. This led to 71 individual conversions in the 17 countries. These conversions helped phase out ODS in equipment which was still in very good operating condition. Otherwise, these owners of ODS-based equipment would have required continuous imports of ODS to meet the servicing needs of their equipment.

In terms of sustainability, the continuance of the activities in question is ensured by the official regulations under the existing environmental legislation in the 17 countries. In addition, the ministries of education ensure continued training through the adoption and inclusion of best practices training into the regular curricula for refrigeration courses at vocational training centres in all 17 countries. Concerning the trade-related aspects, sustainability is assured through the inclusion of ODS issues into the regular training curricula of the various customs services.

Networking activities in South-East Asia and the Pacific and South Asia. Sweden

Maintaining national programmes to phase out ozone-depleting substances constantly presents new technical, financial, legal and managerial challenges. Based on the successful Swedish experience of a network for ODS officers in the Nordic countries during the 1980s, in 1992 the Government of Sweden took an initiative to start up and fund a similar regional network for South-East Asia and the Pacific (SEAP). This network, called the Ozone-depleting Substances Officers' Network for South-East Asia and the Pacific (ODSONET/SEAP), is managed by UNEP. Member countries of ODSONET/SEAP include Brunei Darussalam, Cambodia, Fiji, Indonesia, the Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam, together with two developed countries, Australia and Sweden. The regional network enables national ozone officers from the region to meet twice a year together with representatives of developed countries and the Multilateral Fund's implementing agencies, and provides a forum to discuss regional issues, disseminate information and gather feedback on the policies of the Montreal Protocol and its Multilateral Fund. This peer support system proved so successful that it was quickly adopted by the Multilateral Fund. Today there are nine regional or subregional networks in other parts of the world, which form the backbone of a global ozone network for 139 national ozone units.

The overall objectives of ODSONET/SEAP are to promote early elimination of the use of ODS in member countries of the network, including limiting short-term increases in use, and to help the countries meet their current and upcoming obligations as Parties to the Montreal Protocol, such as to reduce CFC consumption by 85 per cent of baseline by 2007 and achieve final phase-out of CFCs, halons and other ODS by 2010. The project enhances the ability of ODS officers to design and implement phase-out policies, strategies and programmes that are appropriate to the conditions in their countries. It does so by promoting the exchange of experiences, information and approaches between the network's members, developed country partners, technical experts, the Ozone Secretariat, the Multilateral Fund Secretariat, the implementing agencies and other organizations and individuals experienced in ODS phase-out issues.

During the past 15 years, Sweden's support to the network has striven to strengthen the capabilities and confidence of the ODS officers and accelerate the formulation of policies and regulations in the member countries. A faster ODS phase-out has been promoted by sharing ideas, discussing solutions to common problems and replicating each other's best programmes with confidence that they will succeed. One of the biggest achievements of the SEAP network has been the trust established between the ODS officers through the close relationships developed during the network's meetings over the years. This allows the ODS officers to share sensitive information and help each other in achieving the common goals of the Montreal Protocol with less emphasis on national or business interests.

In 2001, Sweden initiated a second networking initiative. Together with UNEP, it established a network for customs and ODS officers in the SEAP region. That network has since been extended to include the South Asia region. The SEAP and South Asia network, with bilateral support from Sweden, has aimed to strengthen cooperation between customs and ozone officers at the regional and national levels to target growing problems of illegal trade of ODS in those regions.

The underlying concept for this initiative was to allow experiences gained in one country to be utilized to abate crime in the others and curb illegal actors and smugglers in more than one country in the region using similar methods. For example, countries can compare their import and export records to see if the names of the registered importing and exporting entities tally. In addition, tracking of shipments in the region is facilitated when customs authorities in the various countries have regular exchanges.

Major achievements from this bilateral project include the development and sharing of information sheets on official importers and exporters in each country; voluntary adoption of prior informed consent procedures to control the export of CFCs to countries in the region, with Singapore taking a leading role; and sharing of information on ODS trade, which has led to bilateral cooperation to address discrepancies between the records of importing and exporting countries. The Swedish project on regional networking between ozone and customs officers is pioneering and has proved to be an effective method for restricting illegal trade. In fact, Multilateral Fund evaluations have recognized the project on customs cooperation as an effective approach to preventing such trade.

In March 2007, Sweden decided to fund an additional new project in this area: regional enforcement networking to improve compliance with other multilateral agreements in the chemicals and wastes area that include trade restrictions (in addition to the Montreal Protocol, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants). The project aims to initiate integrated regional cooperation between countries in North-East, South and South-East Asia and enable the participating countries to gain better control over their imports and exports of chemicals (ODS, persistent organic pollutants and chemical wastes) by promoting further regional cooperation for the control of transboundary movements of those chemicals and wastes. The project aims to improve communication channels for informal information exchange and develop common tools for data management and collaboration, extending the existing ODS enforcement networks by integrating control of transboundary movements on chemicals covered by the Montreal Protocol and the Basel, Rotterdam, and Stockholm conventions.

The financial contributions which Sweden has made to these efforts is in addition to Sweden's financial contribution to the Montreal Protocol. The financial subvention for the ozone and customs networks during the period 1990–2010 has been of the order of SEK 60 million (about \$9 million), including SEK 13.5 million for the period 2007–2010.

Permanent Closure of CFC Production in Mexico. UNIDO

In 2003, UNIDO worked with the Government of Mexico to prepare a project for assistance from the Multilateral Fund to make possible the early elimination of CFC production at the largest Latin American CFC production plant, Cydsa Quimobásicos, which was one of the main CFC exporters in the developing countries.

The \$31.8 million in project funds which were approved were used by the Government as compensation for the profits forgone by the enterprise and also for policy and awareness-raising measures to reduce consumption and to control and regulate domestic and foreign trade in ODS. The compensation provided to Cydsa was used by the company to convert a portion of its CFC production facilities to the production of new types of chemicals not currently banned under the Protocol. This ensured a reliable supply of new refrigerants to the domestic and export markets and maintained employment in the company. The excellent cooperation between the Government, Cydsa and UNIDO and the financial and technical assistance provided throughout the project enabled Mexico to close down production of CFCs in September 2005.

As a result of the project, Mexico was able to comply with its international obligations over four years ahead of schedule. It became one of the first developing countries to phase out the production of CFCs completely. The closure also had a significant impact globally as it tightened the global CFC market and thereby accelerated the reduction of ODS use worldwide. This achievement of Mexico is effectively underpinning international efforts on environmental protection and consequently was specifically commended by the Executive Committee in November 2005.

Coelba's Replacement of Inefficient Refrigerators in the Context of National CFC Phase-Out Plan Actions in Brazil.

UNDP

According to appliance ownership data from Brazilian utilities, 90 per cent of households in low-income communities own refrigerators, and 40 per cent to 50 per cent of those refrigerators are in poor condition. The Ministry of Environment initiated a process whereby agreements with power distribution companies were put in place to replace old and inefficient refrigerators with new, non-CFC-using efficient models. The first agreement and project was established with the Companhia de Eletricidade do Estado da Bahia (Coelba), the electric power distribution company of the state of Bahia. Its aim was twofold: to reduce household electric energy consumption and to recover and reclaim the CFC-12 from used refrigerators, thereby avoiding its release into the atmosphere.

As of June 2007, approximately 8,500 refrigerators had already been replaced. The CFCs from the old refrigerators is collected using the recovery machines provided through the national CFC phase-out project, which is also supported by the Multilateral Fund. The CFCs are then sent to a reclamation centre, which was also established with the support of the Fund. The technicians who collect the CFCs were also trained under the project. The CFC-11 contained in the insulation is also collected, to be disposed of in the future in an environmentally sound manner, as are oils and non-ferrous metals in the old refrigerators. The sheet steel from the old refrigerators is sold as scrap. Money raised through the sale of these materials will be used to fund income-generation projects in the communities. The project has provided work for 130 local people from the communities where the new refrigerators are being distributed. Because of the success of the project, several other power utilities in Brazil are developing similar agreements with the Ministry of Environment, thereby helping the Government achieve its goal of recovering, recycling and reclaiming the CFCs from old equipment.

Bilateral Dialogue Between Mongolia and China. Japan/UNEP

Early on in Mongolia's participation in the Montreal Protocol, there was an appreciation of the significant risk of illegal trade in ODS resulting from Mongolia's geographical location and the circumstances surrounding the expected shortage of CFCs in all countries. In addition, it was understood that border controls over ODS movement between China and Mongolia were important from the viewpoint of preventing illegal ODS movement by way of Mongolia to third countries.

As an innovative attempt to address this issue, Japan and UNEP facilitated a bilateral dialogue between Mongolia and China. This initiative was made possible with the exceptional collaboration of the Chinese National Ozone Unit and the State Environmental Protection Administration of China (SEPA), which committed themselves strongly to preventing illegal trade in ODS. This was done at a time when many Article 5 countries had started to voice concerns about illegal trade in ODS but could not find effective actions to take other than demanding exporting countries to take action, which was difficult in the light of the requirements of World Trade Organization rules. The Mongolia-China dialogue was one of the first examples to start to tackle this problem on a bilateral basis through the voluntary exchange of information between the parties concerned. This dialogue has been continuing as part of the terminal phase-out programme for Mongolia, and similar dialogues have now been undertaken in other difficult areas. The total cost paid by the Fund for the project was \$38,307.

ECOFRIG, HIDECOR and NCCoPP Projects in India. Germany (GTZ Proklima), Switzerland (SDC, INFRAS), UNDP, UNEP, UNIDO

ECOFRIG, HIDECOR and NCCoPP are three consecutive and interdependent projects in the Indian refrigeration and air conditioning sector which demonstrate how the goals of bilateral development assistance combined with bilateral contributions under the Montreal Protocol can effectively strengthen multilateral processes.

ECOFRIG started in 1992 within the framework of Indo-German-Swiss cooperation. The objective of the project was to establish a level playing field for environmentally friendly, “natural” refrigerants in the refrigeration and air conditioning sector. Natural refrigerants such as hydrocarbons do not deplete the ozone layer and have a very low global warming potential compared to hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs), whose use was prevalent at that time.

In the late 1990’s it became clear that refrigeration servicing enterprises generally would not be able to adapt on their own and in time to the new and more demanding non-CFC technologies being chosen by the major producers. At stake was nothing less than the survival of and employment in many small and informal enterprises in an important industrial subsector. Without well-functioning refrigeration servicing enterprises, the servicing of old and new equipment would be compromised. Enhancing the skills of over 39,000 such enterprises employing over 77,000 technicians was therefore recognized as an important aspect in support of the achievement of the Government’s national CFC phase-out targets.

At that time, the Swiss Agency for Development and Cooperation (SDC) focused on refrigeration servicing enterprises from a development policy and environmental protection perspective. As a result, the HIDECOR project was developed by SDC, at first in a pilot phase under the umbrella of ECOFRIG and later as a separate project under Indo-Swiss bilateral cooperation. The methodologies and infrastructure created under HIDECOR also formed the basis for the formulation of a national strategy for phasing out CFCs focusing on refrigeration servicing enterprises. This was approved by the Multilateral Fund as the National CFC Consumption Phase-out Plan (NCCoPP). The sequence from ECOFRIG to HIDECOR to NCCoPP is a remarkable success story of technology transfer and skill development as an integration of bilateral development assistance into multilateral environmental agreements.

As an added benefit, cross-cutting issues between the Montreal Protocol and the Kyoto Protocol could be addressed. Bilateral cooperation is capable of assisting partner countries with the task of integrating actions to enforce and comply with multilateral environmental agreements through support for specific ozone-, climate- and generally environmentally friendly technology options. This positive experience may also be relevant for developing future HCFC phase-out policies which have yet to be formulated for Montreal Protocol Article 5 countries.

Specific Intervention

In Phase I of ECOFRIG (1994–1996), the main focus was on the use of a hydrocarbon (cyclopentane) as a foam blowing agent, while Phase II (1997–2001) brought hydrocarbon refrigerants (in particular a 50:50 blend of propane and isobutane) into production and also into the servicing of domestic and small commercial refrigeration appliances.

Under HIDECOR, a unique and innovative institutional set-up was developed to provide high-quality training in a very cost-effective manner to a large number of technicians who were geographically widely distributed over various regions of the country. Industry partners were involved from the outset, providing training to technicians from small and low-income service enterprises in the informal sector, alongside their own service technicians. The dissemination and outreach strategy of HIDECOR was based on the principle of technology neutrality: equal weight was given to best practices developed for HFC134a-, hydrocarbon- and CFC-12-based technologies. The project also established close cooperation with the Industrial Training Institute (ITI) system, which revised its training syllabus to include non-CFC refrigerants, emission control measures and retrofitting of CFC appliances. In addition, teaching aids for ITI instructors were developed and 456 ITI instructors received training. NCCoPP was modelled on the HIDECOR project and particular emphasis has been placed on retrofitting CFC-based equipment. A crucial part of the implementation of NCCoPP is the provision of cost-effective and adequate equipment to enable refrigeration service enterprises to adopt in their daily routines the best practices taught in the training courses.

To date, most large manufacturers of domestic appliances in India have opted for the hydrocarbon-based foam blowing technology which was introduced under ECOFRIG, and one of India's major refrigerator manufacturers converted its entire refrigerator manufacturing line to hydrocarbon-blend technology during the project (supported by Multilateral Fund funding through the World Bank). The training infrastructure created by HIDECOR has been completely integrated into the NCCoPP strategy, and focuses on the important role of CFC- and non-CFC based best servicing practices. While HIDECOR was geographically restricted to selected states in the south of India, NCCoPP provides similar services for the entire country and all remaining refrigeration servicing enterprises, regardless of size, turnover or linkage to industries. NCCoPP will lead to a complete phase-out of CFC consumption in the refrigeration and air conditioning sector in India.

Methyl Bromide Phase-Out in Lebanon through Successful Public-Private Partnership.

UNDP, UNIDO

Launched in 2001 with funding provided by Multilateral Fund, Lebanon's methyl bromide alternatives project was designed to phase out the consumption of methyl bromide through the use of more environmentally friendly, non-toxic methods. The project has two subproject components: one targeting the elimination of methyl bromide in the production of vegetables, cut flowers and tobacco, implemented by UNDP, and another in the strawberries sector, implemented by UNIDO.

A significant percentage – 85 per cent – of the phase-out to date has been in the vegetables sector, previously the most intensive user of methyl bromide, with annual consumption of 154.7 ODP tonnes. This has been achieved through the application of non-chemical techniques, including soil solarization and biofumigation, with excellent results. Indeed, by 2006 over 8,700 farmers in this sector had been trained in the use of alternatives and had converted their production away from methyl bromide use. The vegetables sector's consumption of 154.7 ODP tonnes a year has been eliminated.

The alternative application methods require the use of low-density polyethylene sheets, indispensable when treating soil with both chemical and non-chemical alternatives, which are used to cover most greenhouse soils and for small greenhouse tunnels. Traditionally, the disposal of used polyethylene - with an estimated annual consumption of 2,000 tonnes – has been by burning, dumping or burying, each of which has environmental repercussions. Under the auspices of the project implemented by UNDP, it was decided that a better solution to the problem had to be found. The project therefore established contact with an existing polyethylene recycling plant located in an extensively agricultural area of Lebanon. The project provided the plant's management with the necessary technical information to add a new parallel line to the factory to allow it to treat used agricultural polyethylene, which was completed using co-financing provided by the private sector. The modifications brought to bear allow the plant to recycle up to an additional 5 tonnes of used polyethylene per day.

Implemented nationally by the Lebanese Ministry of Environment, the project, which demonstrates successful public-private partnership, has proven to be a win-win situation, yielding both environmental and socio-economic benefits.

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