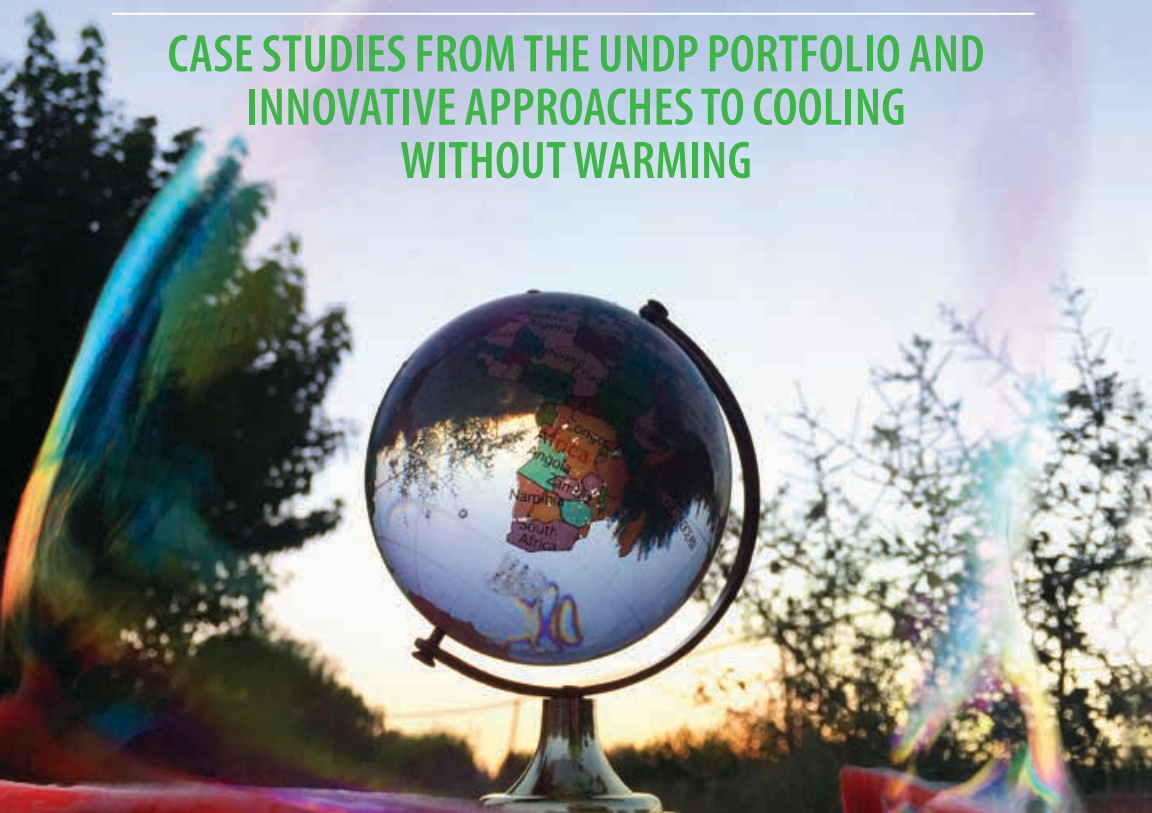




*Empowered lives.  
Resilient nations.*

# PAST SUCCESSES AND FUTURE OPPORTUNITIES

CASE STUDIES FROM THE UNDP PORTFOLIO AND  
INNOVATIVE APPROACHES TO COOLING  
WITHOUT WARMING





CELEBRATION OF 30<sup>TH</sup> ANNIVERSARY OF THE MONTREAL PROTOCOL IN CHINA. PHOTO CREDIT: XIAOFANG ZHOU, UNDP MPU

## ACKNOWLEDGEMENTS

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**Overall Coordinator:** Ms. Xiaofang Zhou, Director, Montreal Protocol/Chemicals Unit, Sustainable Development Cluster, BPPS/UNDP

**Technical Editors:** Frank Pinto and Ajiniyaz Reimov

**Reviewers:** Suely Machado Carvalho, Jacques Van Engel

**Contributors:** Anderson Alves, Selimcan Azizoglu, Panida Charotok, Jacques Van Engel, Monica Gaba Kapadia, Etienne Gonin, Carlos-Andres Hernandez, Kasper Koefoed, Anshu Kumar, William Kwan, Christine Wellington Moore, Frank Pinto, Ajiniyaz Reimov, Manisha Sanghani, Paloma Somohano, Maksim Surkov

**Additional input/support provided by:** Eugenie Blair, Haydee Maramara, Nejat Ncube, Loise Nganga

**Designer:** Camilo J. Salomon @ [www.cjsalomon.com](http://www.cjsalomon.com)

**Printer:** AGS, AN RRD COMPANY, New York

**Front Cover Page Photo Acknowledgement:** "Fragile Layer of Our Planet", Ms. Shamsieva Khurshidakhon Zahirjanovna (Uzbekistan), Second Prize Winner, International Photo Contest sponsored by the Government of Uzbekistan with support from UNDP Uzbekistan on the occasion of the 30<sup>th</sup> Anniversary of the Montreal Protocol, Tashkent, September 2017.

# FOREWORD

The 30<sup>th</sup> Anniversary of the Montreal Protocol is a momentous occasion to celebrate one of, if not the most, successful international environmental agreements to date. The Protocol's achievements are impressive: as a result of countries' shared commitments and cooperation, coupled with the daily choices of individuals around the world, over 98 percent of ozone-depleting substances have been eliminated and we are well on the way to repairing the ozone layer by the middle of the century. In the process, the Protocol has contributed to human health by helping to avoid millions of cases of skin cancer and eye cataracts, and has also had a huge positive impact on agriculture and industrial innovation.

While international efforts to completely phaseout HCFCs continue, we are also moving to the next stage – reducing HFCs under the recently agreed Kigali Amendment, thereby further amplifying the Montreal Protocol's already significant contribution to climate action. Together, the successful implementation of the Montreal Protocol and the Kigali Amendment promise to play a key role in advancing the goals of the Paris Agreement on Climate Change.

Since 1991, UNDP's Montreal Protocol programme has proudly partnered with around 120 countries, supporting them to meet their obligations under the Protocol to protect and regenerate the ozone layer while improving energy efficiency. This report highlights select cases of this work, ranging from successful examples of technological innovation, to training and certification, as well as how South-South cooperation has helped advance this critical agenda. These efforts have greatly benefitted from the very close collaboration and cooperation among the MP Ozone Secretariat, the MP-MLF Executive Committee and Secretariat and Implementing Agencies including UNDP, which has facilitated the adoption of innovative ideas and approaches to tackle the challenges at hand.

We hope the report will serve as a valuable resource for policy makers and practitioners alike, and make an overall contribution to the Montreal Protocol's continued success in advancing sustainable development around the world.



**Achim Steiner**  
Administrator  
United Nations Development  
Programme (UNDP)

# INTRODUCTION

On this 30<sup>th</sup> Anniversary of the Montreal Protocol, we are delighted to share with you examples of UNDP's work in protecting the global ozone layer, advancing sustainable cooling solutions for and tackling climate change, and highlighting linkages to the Sustainable Development Goals.

We are proud to be part of what many consider the world's most successful environmental agreement. Through the joint efforts of our project counterparts in recipient countries, as well as close coordination with MLF and GEF Secretariats, UNDP's cumulative portfolio of 2,496 projects and sector programmes in 120 countries amounting to \$829.6 million has already eliminated 70,321 ODP tonnes per annum, generated cumulative climate benefits of 6.48 billion tonnes of CO<sub>2</sub> eq. emissions, and catalyzed innovative solutions for environment-friendly alternatives as this report shows. Special thanks are due to ASG Magdy Martinez-Soliman, Director of BPPS, and Nik Sekhran, Chief, Sustainable Development Cluster, for their continued support and encouragement of the programme.

We are also proud that UNDP has worked across funds, with bilateral agencies and on South-South and gender aspects under this programme. UNDP will continue to support countries develop green, efficient and sustainable solutions in the relevant sectors and help countries achieve their MP phaseout targets.



**Xiaofang Zhou**  
Director,  
Montreal Protocol/Chemicals Unit  
Sustainable Development Cluster  
Bureau for Policy and  
Programme Support  
UNDP

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INDIA STUDY TOUR PARTICIPANTS EXAMINING FOAM PRODUCTS IN CHINA. PHOTO CREDIT: YUN WAN, UNDP CHINA



# 30 YEAR RETROSPECTIVE ON THE MONTREAL PROTOCOL

The Montreal Protocol (MP) on the protection of the global ozone layer is a somewhat unique example of how the world can respond when faced with a serious environmental threat. The 1974 Rowland-Molina hypothesis was that CFCs in the stratosphere – when bombarded by UV radiation – could result in chlorine radicals that could destroy large numbers of ozone molecules and lead to ozone layer depletion. This in turn would lead to more UV radiation reaching the earth, contributing to increasing levels of skin cancer and cataracts, reduced effectiveness of vaccines, as well as slower plant growth and negative impact on marine phytoplankton.

This hypothesis was ignored until the discovery of the Antarctic “ozone hole” in 1985 that shocked the world, proving the Rowland-Molina hypothesis was correct. Action was immediate. In 1985 itself, the Vienna Convention was adopted and in 1987, the Montreal Protocol (MP) was agreed upon. This was the fastest response – ever – of the international community to a severe international environmental problem. And in 1991, the Multilateral Fund (MLF) for the Implementation of the Montreal Protocol was established to assist developing countries transition away from ozone-depleting substances (ODS).

## Why has the Montreal Protocol been so special?

The question is often asked why the world moved so quickly and effectively in dealing with ozone layer depletion. Several reasons come to mind:<sup>1</sup>

- **New area of work and scientific consensus** This was a new area of research and work without many vested interests. The analysis carried out by the Montreal Protocol’s Scientific Assessment Panel (SAP), the Environmental Effects Assessment Panel (EEAP) and the Technology and Economic Assessment Panel (TEAP) ) and its sector specific Technical Options Committees (TOCs) was accepted and acted upon. This also allowed for future amendments and adjustments to the Protocol to be agreed upon based on new emerging evidence.
- **The role of technical innovation** Skeptics had long said that CFCs were irreplaceable. However, industrialized countries took the lead in technical innovation. Developing countries under the MLF and its four implementing agencies (UNDP, UNEP, UNIDO, World Bank) – and some bilateral partners – followed rapidly with applied technical innovation almost every year, from 50% reduced CFCs during 1991-92 to even lower ODP CFC alternatives during 1993-94, to the introduction in 1994 of hydrocarbons in sectors where CFCs were used, and the introduction during 1995-96 of HCFC-22 in refrigeration and other low-ODS in the foams, solvents and fire extinguishing sectors. The speed of this technical innovation/evolution – especially during the first five years (1991-1996) of the Protocol – has not been matched by any other environmental convention or protocol.
- **Chemical suppliers on board** The major ODS chemical producers worldwide – instead of fighting this development – decided to join it even though they would be giving up in the beginning on a very lucrative business. They led the search for non-ODS alternatives and were able to develop new lines of business to replace those they had lost. So industry, in general, was very supportive of the MP. This public-private sector cooperation helps explain the success of the MP.

<sup>1</sup> Frank Pinto, *Environment Initiatives by the United Nations Including RIO+20*, presentation to the visiting Vienna University graduate student group to the United Nations, New York, 20 February 2015.



CHILDREN'S DRAWING COMPETITION TO CELEBRATE THE 30TH ANNIVERSARY OF THE MONTREAL PROTOCOL IN INDIA.  
PHOTO CREDIT: NATIONAL OZONE UNIT, INDIA

- **Capacity building, training and institutional development** The MLF Executive Committee (ExCom) decided early in the process to give priority to – and allocate funding for – capacity building, training and institutional development in recipient developing countries to ensure long-term success. National Ozone Units were created and strengthened, and this paid immense dividends when national compliance mechanisms had to be formulated, and these National Ozone Units were able to take the lead in developing national legislation and supporting compliance mechanisms.
- **Developed-Developing country cooperation** A unique form of cooperation between developed and developing countries under the MP that facilitate technology transfer was unprecedented.
- **Effective trade regulations** The MP adopted very clear prohibitions on ODS trade with non-Parties to the Protocol. This resulted in 197 Parties to the Protocol ratifying it in record time, so that recipient countries would have access to ODS during the transition process to new technologies. And these policies were strictly enforced, stopping trade in illegal ODS and thus facilitating the conversion process. It demonstrates that difficult environmental issues can be tackled and resolved successfully in an equitable and sustainable manner.<sup>2</sup>
- **Special handling for SMEs** During its first five years (1991-96), the MLF ExCom focused on conversion of larger ODS producing and consuming

enterprises in recipient countries, given the need to show results and tackle the largest units first. It was, however, soon recognized that there were thousands of small and medium sized enterprises (SMEs) whose ODS consumption individually may have been small but which were labour-intensive, employing a large number of workers. With larger enterprises converting to non-ODS technologies, SMEs faced the prospect of being driven out of business with the loss of thousands of jobs. So the MLF ExCom developed guidelines to facilitate the ODS transition process in SMEs, with UNDP taking the lead in developing new and innovative processes under umbrella projects which comprised local manufacture of inexpensive, low maintenance equipment which had low operational costs which the SMEs could afford. As a result, SMEs were able to successfully transition to new non-ODS technologies and maintain both market share and employment levels, thereby safeguarding livelihoods. This approach proved invaluable when dealing with MLF ExCom approved sector (e.g. aerosols, foam, fire extinguishing, solvents and refrigeration) ODS phaseout programmes followed by national ODS phaseout programmes.

## The Montreal Protocol and Climate Change

While the Montreal Protocol was established to eliminate ODS, since most ODS are also potent greenhouse gases, their phaseout has had considerable co-benefits for climate change mitigation. For instance

<sup>2</sup> Suely Carvalho, *Partnerships for Change: 25th Anniversary of the Montreal Protocol (1987-2012)*, UNDP, September 2012.

CFC-11 has a GWP of 4,750 (compared to 1.0 for CO<sub>2</sub>) and CFC-12 has a GWP of 10,900. As the MP continued eliminating ODS, it was also able to reduce their global warming potential significantly.

In this section and in the case studies that follow, the CO<sub>2</sub> eq. emissions are calculated by getting the GWP values from the latest IPCC Assessment and multiplying it by the tonnes of ODS eliminated.

The Economist<sup>3</sup>, in a special September 2014 issue on climate change, reported that the Montreal Protocol had, during the period 1989-2013, reduced cumulative CO<sub>2</sub> eq. emissions by between 130-135 billion tonnes<sup>4</sup>. So the Montreal Protocol has been a very effective climate mitigation tool compared to other global policy actions.

Some of the ODS-replacement chemicals also had significantly high GWPs. For example, HCFCs have GWPs in the 725-2,310 range and HFCs have GWPs in the 675-14,000 range. HCFCs are already in the process of being phased out. Given the huge quantities of HFCs already in use, it was argued that if the MP were quickly amended to include them, it might be possible for the MP to eliminate the CO<sub>2</sub> equivalent of as much greenhouse gas emissions in the next 35 years as the MP did during 1990-2010. MP Parties also felt that the increase of HFCs in sectors the Montreal Protocol institutions worked with, especially refrigeration and A/C, was due to the alternatives to ODS introduced to comply with the MP.

Proposals to include HFCs under the MP (even though they do not affect the ozone layer) were intensively discussed at MP meetings during 2009-2016 – they relate to the same sector as those addressed under the MP, and given the proven success of the MP, it was felt that the transition from HFCs to new alternatives could be done faster under the MP as compared to other options. The contribution of the HFC Amendment to climate and its large contribution to the reduction of the earth's temperature was key to the support of the inclusion of HFCs in the MP. According to the MP Ozone Secretariat, "it is expected that this will avoid up to 0.5°C warming by the end of the century, while continuing to protect the ozone layer".

## The MP Kigali Amendment

In October 2016, during the 28<sup>th</sup> MP MOP in Kigali, Rwanda, 197 countries adopted the "Kigali Amendment" on HFCs. The Kigali Amendment establishes specific targets and timetables to phasedown production and consumption of HFCs, with developed countries agreeing to help finance the transition of developing countries to help meet the global commitment to avoid over 80 billion metric tons of CO<sub>2</sub> eq. emissions by 2050.<sup>5</sup>

Countries ratifying the Kigali Amendment commit to cut their production and consumption of HFCs by over 80% over the next 30 years. Most developed countries will start reducing HFCs by 2019, while developing countries (so called Group 1) will freeze their HFC production and consumption in 2024.

In addition, countries also agreed to begin examining opportunities to increase the energy efficiency of appliances and equipment to achieve additional GHG mitigation, while also delivering sustainable development benefits such as better air quality, improved public health, improved energy access and energy security. Efforts made by countries to phasedown HFCs can be part of their Nationally Determined Contributions (NDCs) under the Paris Agreement of the UNFCCC.

Developing countries that are Parties to the Kigali Amendment can access financial and technical support under the MLF to meet their HFC reduction targets. In 2017, a group of developed countries donated \$27 million in "fast start funds" to help developing countries take early action and build capacities to support HFC phasedown activities; these funds will be channeled through the MLF. In addition, 19 philanthropies contributed \$52 million to support developing nations in the transition to more energy-efficient cooling solutions through the Kigali Cooling Efficiency Programme (K-CEP), with the goal to "significantly increase and accelerate climate and development benefits of the Montreal Protocol refrigerant transition by maximizing a simultaneous improvement in the energy efficiency of cooling."<sup>6</sup>

<sup>3</sup> The Economist, *Curbing Climate Change: The Deepest Cuts: Our guide to the actions that have done the most to slow global warming*, pgs 21-23, 20 Sept. 2014 (print edition).

<sup>4</sup> The Economist estimations are based on: UNEP, "The Montreal Protocol and the Green Economy" (2012) and "Growth of climate change commitments from HFC banks and emissions" by Velders G.J.M. et al, *Atmos. Chem. Phys. Discuss.* 2014

<sup>5</sup> <https://obamawhitehouse.archives.gov/the-press-office/2016/10/15/fact-sheet-nearly-200-countries-reach-global-deal-phase-down-potent>

<sup>6</sup> [www.climateworks.org/blog/kigali-cooling-efficiency-program-k-cep-exciting-new-philanthropic-initiative-makes-debut/](http://www.climateworks.org/blog/kigali-cooling-efficiency-program-k-cep-exciting-new-philanthropic-initiative-makes-debut/)





UNDP ADMINISTRATOR SPEAKING AT THE HIGH LEVEL EVENT ON RATIFICATION OF THE KIGALI AMENDMENT TO THE MONTREAL PROTOCOL AT THE UNITED NATIONS, NEW YORK, SEPTEMBER 2017. PHOTO CREDIT: THE MINISTRY OF ENVIRONMENT OF RWANDA

The MLF Executive Committee, at its July 2017 meeting, decided that Enabling Activities will support early ratification of the Kigali Amendment – these could include developing institutional arrangements, review of licensing systems, data reporting on HFC consumption and production, and national strategies. Stand-alone Investment Projects are invited for submission to the 79<sup>th</sup> ExCom Meeting onwards. The ExCom is developing the cost guidelines for funding HFC phasedown activities. The preparation of National Implementation Plans could start as early as 2019, before the Kigali Amendment baseline numbers are set (average 2020-2022 for Group 1 countries).

UNDP is one of the most active agencies supporting countries in their refrigerant transition to climate-friendly technologies as well as helping countries promote energy efficiency in the refrigeration and A/C sectors. UNDP supported 16 countries in undertaking their national surveys on the consumption of ODS Alternatives, with financial assistance both from the MLF and the CCAC. These surveys provided countries valuable information on the current consumption of high-GWP HFCs per sector, and also supported them in the growth forecast for these substances, proving to be important decision-supporting tool during the Amendment negotiations.

As “quick start” actions in response to 2017 ExCom decisions, UNDP quickly developed full-size stand-alone investment projects to support

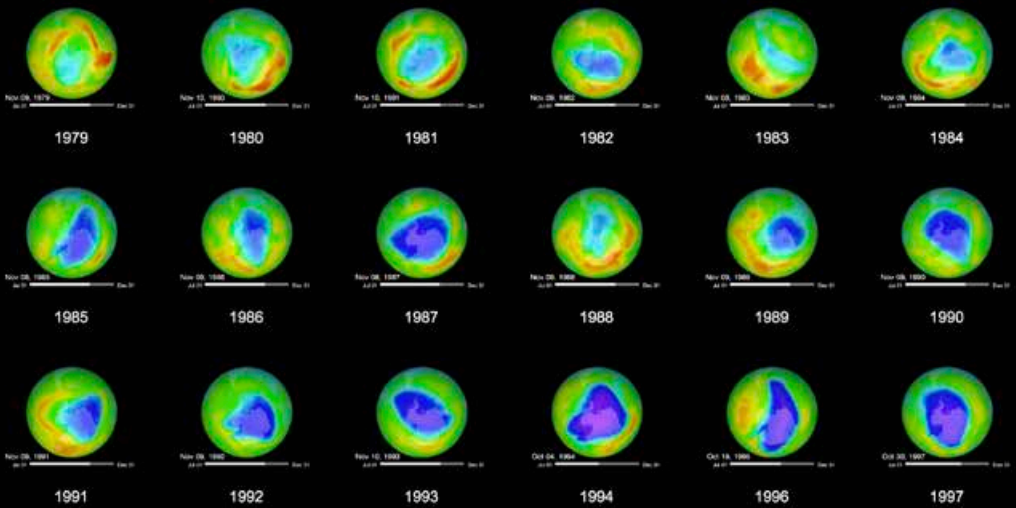
conversion from HFC-134a to R600a in domestic refrigerator manufacturing in Bangladesh, Colombia and Mexico, as well as projects to replace HFCs in mobile A/C, commercial refrigeration and foam applications in China, the Dominican Republic, Egypt and Zimbabwe. UNDP also supports countries carry out their Enabling Activities to facilitate the ratification process and strengthen national capacities to meet the initial obligations of the Kigali Amendment.

UNDP already works with several countries<sup>7</sup> on combining refrigerant substitution with energy efficiency gains in refrigeration and A/C products and systems, and on combining funding from the MLF, GEF, K-CEP and CCAC. As a K-CEP partner, UNDP will assist 14 countries strengthen their energy efficiency capacities and develop national cooling strategies, as well as conduct synergistic activities to achieve additional efficiency gains through their HFC reduction projects and ongoing HPMPs.

## Reflections on HPMP Design and Implementation

UNDP is implementing HCFC Phase-out Management Plans (HPMPs) in MLF 47 recipient countries, covering large (e.g. Brazil, China, India, Indonesia, Nigeria), medium (e.g. Colombia) and smaller (e.g. Barbados, Fiji, Maldives) ODS consumers. HPMPs are “performance-based agreements” between the country and the MLF ExCom, whereby agreed-upon funding tranches are released when conditions related

<sup>7</sup> Mauritius, Indonesia, China, Maldives, Honduras, Chile, Costa Rica, Cuba, Panama, Uruguay, Venezuela, Malaysia, Bangladesh, Sri Lanka, Ghana, Nigeria, Lebanon and Trinidad & Tobago.



CHANGES IN THE OZONE LAYER OVER ANTARCTICA FROM 1979 TO 2015. LOS ANGELES TIMES WWW.LATIMES.COM. PHOTO CREDIT: ANGELICA QUINTERO AND ARMAND EMAMNDJOMEH. SOURCE: NASA OZONE WATCH

to ODS phaseout and disbursements are met. As of mid-2017, the ExCom had approved 200 tranches for UNDP, corresponding to an ODS phaseout of 2,360 ODP tonnes and a combined budget of \$215.3 million for both Stage 1 and Stage 2 HPMPs. In addition, UNDP implements GEF-funded HPMPs in 4 CEIT countries corresponding to 77 ODP metric tonnes and \$9 million.

HPMP implementation involves a package of technology and policy interventions for phasing out HCFCs to comply with the control targets of the Montreal Protocol HCFC phaseout schedule, and at the same time avoiding the introducing of high GWP HFC alternatives when available and economically feasible. UNDP has also assisted companies customize and, in some cases, make final product economically viable to be used in developing countries.

**In low-volume consuming countries (LVCs), HPMP activities are usually for:**

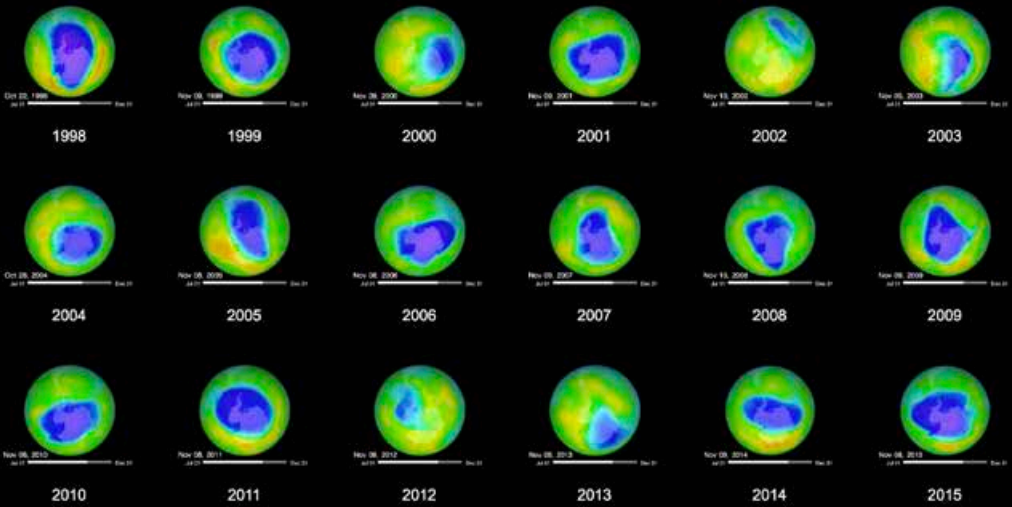
- policy interventions such as legislative action, implementation of a licensing/quota system, assistance to customs to control the import of ODS, etc.
- assistance provided to the refrigeration servicing sector, including training of refrigeration servicing technicians, recovery/recycling schemes and limited assistance to the refrigeration end-user sectors

(e.g. for cooling used in supermarkets, hospitals, hotels, restaurants, cold storage rooms, meat and fish processing industry, refrigerated transport, air-conditioning and chillers, etc).

**For larger-consuming countries, assistance to manufacturing industry is also covered:**

- Foam sector: where enterprises producing foam-products receive financial and technical assistance to convert their manufacturing processes to use low-GWP alternatives such as hydrocarbons, methyl formate, methylal and HFOs, so they no longer need HCFCs as a blowing agent. Products can range from refrigerator cabinets, foam panels, thermoware, sprayfoam applications, integral skin, etc.
- Refrigeration and A/C sector: where HCFC coolant used in the manufacturing line is replaced by low-GWP alternatives such as CO<sub>2</sub>, ammonia, hydrocarbons and HFOs, and in some cases HFC-32 and HFO/HFC blends due to special situations.
- Solvents sector: where HCFC-based machines manufactured to clean or degrease metal devices can be replaced with technologies that are ODS-free.

To ensure that a country remains in compliance with its HPMP agreement, a mix of the above policy and phaseout activities must be enacted to allow the



country to sufficiently reduce its dependence and imports of HCFCs. UNDP, in most cases, works hand in hand with other multilateral/bilateral agencies to implement HPMPs. Our partners include UNEP (China, India, most LVCs), UNIDO (e.g. Brazil, China, Egypt, Nigeria), the World Bank (China), GIZ (e.g. Brazil, India), Italy (Brazil and Ghana), and Japan (China, Colombia, India).

While most Stage-1 HPMPs which involve the 2013 and 2015 HCFC MP control measures are in an advanced stage of implementation, a new round of Stage-2 HPMP approvals started in 2016 which will address the HCFC control measures through 2020 and for many countries, beyond that year. These new approvals will encounter additional challenges such as:

- During Stage 1 HPMPs, higher ODP HCFCs (e.g. HCFC-141b), and sectors (e.g. foams) were prioritized for larger enterprises, where cost-effective conversions could easily be implemented.
- During Stage 2, many SMEs would have to be covered. For enterprises with low HCFC consumption levels, established alternatives to HCFCs (e.g. hydrocarbons) did not always provide a sustainable solution in terms of costs and safety issues.
- In sectors not addressed in Stage 1, HCFC alternatives are in various stages of development and market introduction and reliable data on costs, availability and performance is not readily available.
- This is especially relevant in Stage II HPMPs Refrigeration and A/C manufacturing sectors where uncertainties often exist on the choice and availability of lower or similar cost alternative lower-GWP technologies, especially lack of compressors for the A/C sector. If not tackled soon, these sectors may have a significant “servicing tail” which may lead to HCFC compliance problems in a few years or market transition to high-GWP HFC technology. On the other hand, embarking on a phaseout too soon could leave enterprises stuck with challenges of an early transition to low-GWP technology. Additional measures and incentives would have to be introduced (and working together with other funds, such as GEF, Green Climate Fund and K-CEP may be needed more than ever).
- UNDP has significant experience in facilitating technology assessments of emerging alternatives in various sectors and has been submitting Stage-2 HPMPs which will utilize different low and lower GWP alternatives for HCFCs in a number of priority sectors.

# UNDP'S WORK ON OZONE LAYER PROTECTION AND IMPACT

 NUMBER OF PROJECTS

 MLF OR GEF GRANT (US\$ 000)










 TONNES OF ODS PHASED OUT

 6.48

ESTIMATED CUMULATIVE CLIMATE BENEFITS (BILLION TONNES OF CO<sub>2</sub>-EQ REDUCTION)

**MLF** 6.29  
**GEF** 0.20



MLF				MLF				MLF						
1	ARMENIA	8	848	2	13	COMOROS	2	75	25	25	GUINEA-BISSAU	2	308	14
2	BAHRAIN	8	1,042	96	14	CONGO	5	371	25	26	JAMAICA	14	1,659	110
3	BANGLADESH	32	7,134	494	15	DJIBOUTI	5	335	10	27	JORDAN	2	41	-
4	BELIZE	8	402	12	16	DOMINICA	3	103	1	28	KUWAIT	2	313	-
5	BENIN	2	158	27	17	ERITREA	1	20	-	29	KYRGYZSTAN	16	1,454	65
6	BHUTAN	7	279	-	18	FIJI	9	488	17	30	LAO, PDR	5	371	16
7	BRUNEI DARUSSALAM	4	507	53	19	GABON	9	452	18	31	LEBANON	51	12,966	876
8	BURKINA FASO	2	149	31	20	GAMBIA	6	311	15	32	MALAWI	13	3,500	178
9	BURUNDI	10	470	48	21	GEORGIA	18	1,453	30	33	MALDIVES	7	791	3
10	CAMBODIA	10	1,468	70	22	GHANA	33	4,447	418	34	MAURITIUS	5	674	30
11	CAPE VERDE	2	99	1	23	GRENADA	4	153	4	35	MOLDOVA, REP.	14	1,147	88
12	CENTRAL AFRICAN REP.	3	143	-	24	GUINEA	2	70	8	36	MYANMAR	1	20	-





# FUNDING SOURCE



120  
NUMBER OF COUNTRIES

MLF 105  
GEF 15



2,496  
NUMBER OF PROJECTS

MLF 2,456  
GEF 40



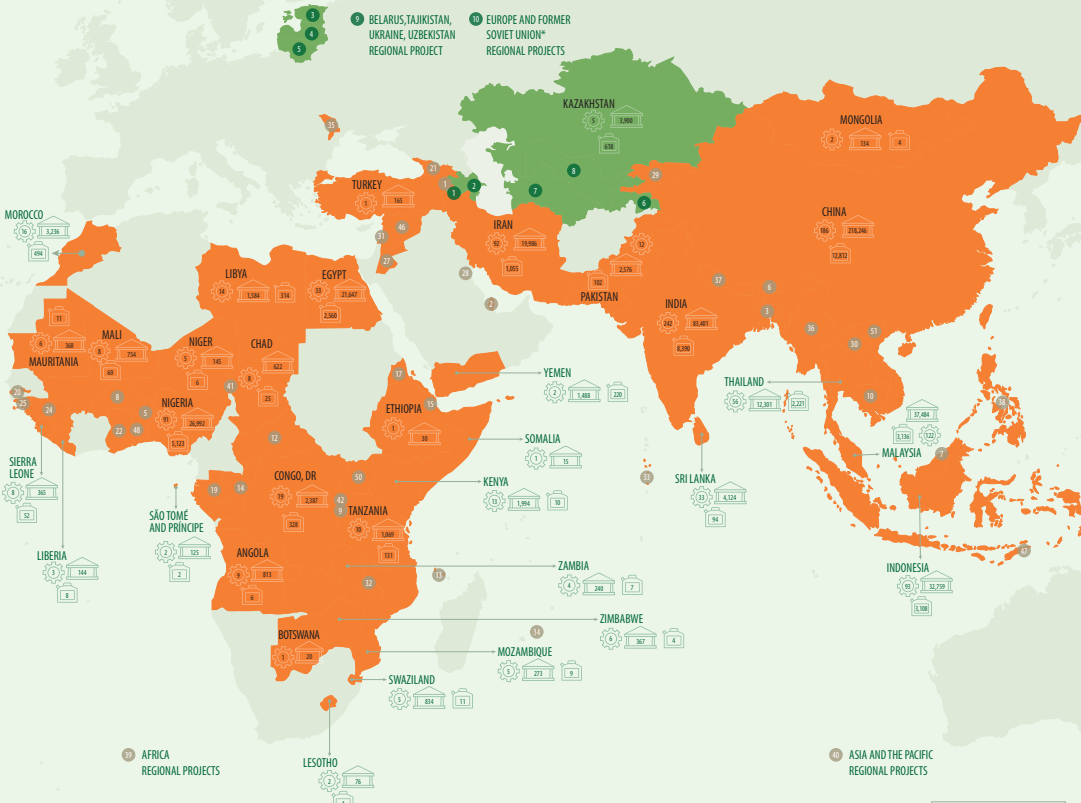
829.653  
TOTAL GRANT VALUE (US\$ mln)

MLF 787.153  
GEF 42.500



70,320.7  
TONNES OF ODS PHASED OUT

MLF 68,137.7  
GEF 2,183.0



MLF			
37 NEPAL	11	396	18
38 PHILIPPINES	32	7,066	755
39 REGION: AFR	6	1,140	63
40 REGION: ASP	5	280	—
41 REGION: LAC	7	1,462	—
42 RWANDA	6	319	18
43 SAINT KITTS AND NEVIS	3	145	—
44 SAINT VINCENT AND THE GRENADINES	2	128	2
45 SAMOA	2	75	—
46 SYRIA	19	5,166	531
47 TIMOR LESTE	2	106	—

MLF			
48 TOGO	7	459	30
49 TRINIDAD AND TOBAGO	25	2,863	120
50 UGANDA	3	74	4
51 VIETNAM	19	1,560	283
GLOBAL	49	5,282	—

GEF			
1 ARMENIA	5	1,500	52
2 AZERBAIJAN	4	6,100	307
3 ESTONIA	2	500	42
4 LATVIA	3	1,100	224
5 LITHUANIA	4	3,900	368
6 TAJIKISTAN	2	500	25
7 TURKMENISTAN	1	100	31
8 UZBEKISTAN	2	2,600	127
9 REGION: BELARUS, TAJIKISTAN, UKRAINE, UZBEKISTAN	1	9,000	289
10 REGION: EUROPE AND FORMER SOVIET UNION*	11	13,300	100

\* Armenia, Azerbaijan, Belarus, Bulgaria, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan

# THE MONTREAL PROTOCOL AND THE SDGs

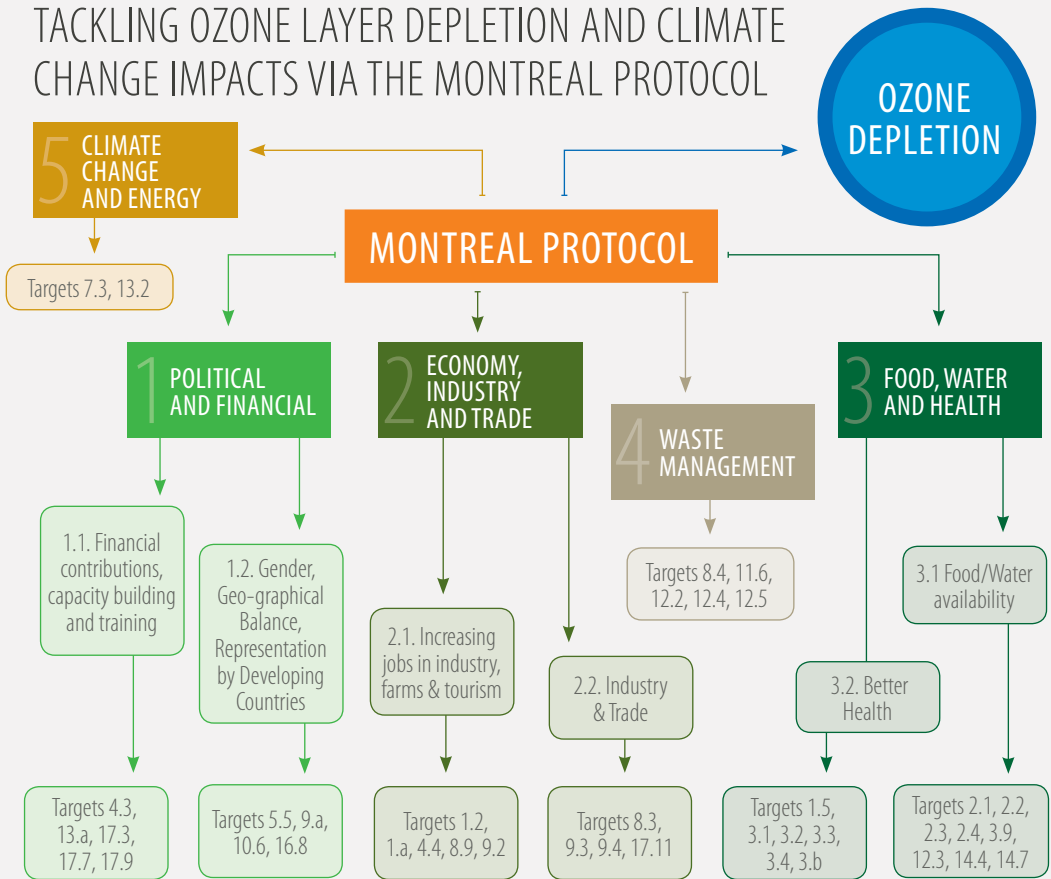
IN AUGUST 2017, UNDP/MPU COMMISSIONED A STUDY<sup>8</sup> TO ANALYZE IN DETAIL THE LINKAGES BETWEEN THE MONTREAL PROTOCOL AND THE SDGs.

The report notes that MP work needs to report on its contributions to the SDGs. The report found that **15 of the 17 SDG-goals** and **39 of the 169 SDG-targets** are indeed impacted by the MP programme, as summarized below:

<p><b>1</b> NO POVERTY</p> 	<p>End poverty in all its forms everywhere NUMBER OF TARGETS WITH MP LINKAGES <b>3</b> TARGET GOAL NUMBERS <b>1.2, 1.5, 1.a</b></p>	<p><b>11</b> SUSTAINABLE CITIES AND COMMUNITIES</p> 	<p>Make cities and human settlements inclusive, safe, resilient and sustainable NUMBER OF TARGETS WITH MP LINKAGES <b>1</b> TARGET GOAL NUMBER <b>11.6</b></p>
<p><b>2</b> ZERO HUNGER</p> 	<p>End hunger, achieve food security and improved nutrition and promote sustainable agriculture NUMBER OF TARGETS WITH MP LINKAGES <b>4</b> TARGET GOAL NUMBERS <b>2.1, 2.2, 2.3, 2.4</b></p>	<p><b>12</b> RESPONSIBLE CONSUMPTION AND PRODUCTION</p> 	<p>Ensure sustainable consumption and production patterns NUMBER OF TARGETS WITH MP LINKAGES <b>4</b> TARGET GOAL NUMBERS <b>12.2, 12.3, 12.4, 12.5</b></p>
<p><b>3</b> GOOD HEALTH AND WELL-BEING</p> 	<p>Ensure healthy lives and promote well-being for all at all ages NUMBER OF TARGETS WITH MP LINKAGES <b>6</b> TARGET GOAL NUMBERS <b>3.1, 3.2, 3.3, 3.4, 3.9, 3.b</b></p>	<p><b>13</b> CLIMATE ACTION</p> 	<p>Take urgent action to combat climate change and its impacts NUMBER OF TARGETS WITH MP LINKAGES <b>2</b> TARGET GOAL NUMBERS <b>13.2, 13.a</b></p>
<p><b>4</b> QUALITY EDUCATION</p> 	<p>Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all NUMBER OF TARGETS WITH MP LINKAGES <b>2</b> TARGET GOAL NUMBERS <b>4.3, 4.4</b></p>	<p><b>14</b> LIFE BELOW WATER</p> 	<p>Conserve and sustainably use the oceans, seas and marine resources for sustainable development NUMBER OF TARGETS WITH MP LINKAGES <b>2</b> TARGET GOAL NUMBERS <b>14.4, 14.7</b></p>
<p><b>5</b> GENDER EQUALITY</p> 	<p>Achieve gender equality and empower all women and girls NUMBER OF TARGETS WITH MP LINKAGES <b>1</b> TARGET GOAL NUMBER <b>5.5</b></p>	<p><b>16</b> PEACE, JUSTICE AND STRONG INSTITUTIONS</p> 	<p>Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels NUMBER OF TARGETS WITH MP LINKAGES <b>1</b> TARGET GOAL NUMBER <b>16.8</b></p>
<p><b>7</b> AFFORDABLE AND CLEAN ENERGY</p> 	<p>Ensure access to affordable, reliable, sustainable and modern energy for all NUMBER OF TARGETS WITH MP LINKAGES <b>1</b> TARGET GOAL NUMBER <b>7.3</b></p>	<p><b>17</b> PARTNERSHIPS FOR THE GOALS</p> 	<p>Strengthen the means of implementation and revitalize the Global Partnership for sustainable development NUMBER OF TARGETS WITH MP LINKAGES <b>4</b> TARGET GOAL NUMBERS <b>17.3, 17.7, 17.9, 17.11</b></p>
<p><b>8</b> DECENT WORK AND ECONOMIC GROWTH</p> 	<p>Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all NUMBER OF TARGETS WITH MP LINKAGES <b>3</b> TARGET GOAL NUMBERS <b>8.3, 8.4, 8.9</b></p>	<p>The above-listed targets were then grouped around 5 clusters with the following themes:</p>	
<p><b>9</b> INDUSTRY INNOVATION AND INFRASTRUCTURE</p> 	<p>Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation NUMBER OF TARGETS WITH MP LINKAGES <b>4</b> TARGET GOAL NUMBERS <b>9.2, 9.3, 9.4, 9.a</b></p>	<p>1. <b>Political and Financial aspects</b> related to the Montreal Protocol. This further is subdivided into: 1.1. Financial contributions, capacity building and training (5 SDG-targets) 1.2. Gender, Geographical Balance, representation by Developing Countries in Institutions (4 SDG-targets)</p>	
<p><b>10</b> REDUCED INEQUALITIES</p> 	<p>Reduce inequality within and among countries NUMBER OF TARGETS WITH MP LINKAGES <b>1</b> TARGET GOAL NUMBER <b>10.6</b></p>	<p>2. <b>Economy, Industry &amp; Trade aspects</b> related to the Montreal Protocol. This further is subdivided into: 2.1. Increasing Job opportunities in industry, farms and tourism (6 SDG-targets) 2.2. Industry and Trade (4 SDG-targets)</p>	
		<p>3. <b>Food, water and Health aspects</b> related to the Montreal Protocol. This further is subdivided into: 3.1. Ensuring Food/Water availability (8 SDG-targets) 3.2. Better Health (6 SDG-targets)</p>	
		<p>4. <b>Better Waste Management aspects</b> related to the Montreal Protocol (5 SDG-targets)</p>	
		<p>5. <b>Combating Climate Change and save Energy</b> related to the Montreal Protocol (2 SDG targets)</p>	

<sup>8</sup> Jacques Van Engel, "The Sustainable Development Goals and the Montreal Protocol", an analysis prepared for UNDP's Montreal Protocol/Chemicals Unit, 20 August 2017.

# TACKLING OZONE LAYER DEPLETION AND CLIMATE CHANGE IMPACTS VIA THE MONTREAL PROTOCOL



## OVERALL IMPACT OF THE MONTREAL PROTOCOL



### HEALTH

The following health benefits for those born between 1890 and 2100 in the United States<sup>9</sup>:



**283 MILLION**

cases of skin cancer prevented, 8.3 million of which are melanoma.



**1.6 MILLION**

deaths from skin cancer prevented.



**46 MILLION**

cases of cataracts prevented.

At a global level, up to 2 million cases of skin cancer may be prevented each year by 2030, along with additional avoided cataracts cases.



### CLIMATE

The Montreal Protocol has so far averted estimated emission of around **130-135 BILLION** tonnes of CO<sub>2</sub> equivalent<sup>10</sup>.



### ECONOMY

Among the economic benefits of the Montreal Protocol are savings in healthcare costs. Reducing the number of skin cancer cases could save billions of dollars across the globe. In the United States alone, research published by the Centers for Disease Control and Prevention in November 2014 revealed that the average cost of treating **4.9 MILLION** adults for any skin cancer each year reached \$8.1 billion between 2007 and 2011.<sup>9</sup>

<sup>9</sup> <http://web.unep.org/newscentre/collated-research-reveals-full-scale-montreal-protocols-ozone-layer-repair-work> and [www.epa.gov/sites/production/files/2015-07/documents/updating\\_ozone\\_calculations\\_and\\_emissions\\_profiles\\_for\\_use\\_in\\_the\\_atmospheric\\_and\\_health\\_effects\\_framework\\_model.pdf](http://www.epa.gov/sites/production/files/2015-07/documents/updating_ozone_calculations_and_emissions_profiles_for_use_in_the_atmospheric_and_health_effects_framework_model.pdf)

<sup>10</sup> "The Economist estimations are based on: UNEP, "The Montreal Protocol and the Green Economy" (2012) and "Growth of climate change commitments from HFC banks and emissions" by Velders G.J.M. et al, Atmos. Chem. Phys. Discuss. 2014

# TECHNOLOGY DEMONSTRATION PROJECTS

## Replacing HCFC-22 with Ammonia/CO<sub>2</sub> In Cascade Refrigeration Systems



### CHINA: Yantai Moon

As a refrigerant, HCFC-22 has been widely used in refrigeration equipment and systems. Technological advancements in alternative, natural refrigerants, such as ammonia/CO<sub>2</sub> cascade refrigeration systems, have provided a clear solution for replacing HCFC-22 in industrial and commercial refrigeration. Ammonia/CO<sub>2</sub> cascade refrigeration systems are 15% more efficient than traditional HCFC-22 systems. The success of the project is due to technology acquisition, system integration, limit filling technologies, CO<sub>2</sub> heat transfer, oil return, safety research and enterprise commitment.

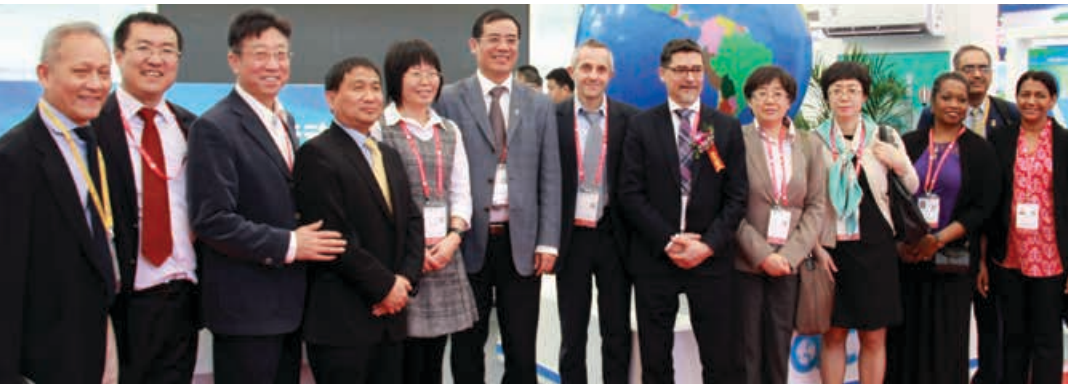
Yantai Moon is the first enterprise in China to carry out CO<sub>2</sub> subcritical research and application. In May 2011, the company started this demonstration project with UNDP technical assistance. During implementation, three demonstration subprojects were completed and positive results achieved in environmental protection, safety, and energy conservation. The project was successfully completed in July 2013. By end-2016, MLF incremental operating costs were applied at over 100 converted cold storage units, and 180 CO<sub>2</sub> refrigeration systems were built, all of which are in full operation. Users include livestock meat processing industry, aquatic processing industry freezing and refrigeration, the beer industry, and the artificial environment.

The CO<sub>2</sub> system is environmentally friendly and saves energy. The charge amount of ammonia is effectively reduced to less than 20% compared to the conventional system, and the efficiency can be increased more than 10%. Users also benefit by saving on operating costs. The industrial temperature range of refrigeration is "-50°C~5°C.

This demonstration project eliminated the use of 250 tonnes of HCFC-22 and reduced greenhouse gas (GHG) emissions equivalent to 425,000 tonnes of CO<sub>2</sub>. It is estimated that future sales of such systems will increase by over 150 units/year, eliminating 375 tonnes of HCFC-22 per year and reducing GHG emissions equivalent to 637,500 tons of CO<sub>2</sub>. UNDP's partner institution was the Foreign Economic Cooperation Office (FECO), Ministry of Environment Protection, China.



WORKSHOP OF CHINA'S LARGEST NH<sub>3</sub>/CO<sub>2</sub> REFRIGERATION SYSTEM WITH 16 SETS EACH OF NH<sub>3</sub> AND CO<sub>2</sub> COMPRESSORS. PHOTO CREDIT: YANTAI MOON GROUP CO. LTD.



LAUNCH OF STAGE II INDUSTRIAL AND COMMERCIAL REFRIGERATION SECTOR PLAN IN SHANGHAI, APRIL 2017.

PHOTO CREDIT: FECO/MEP, CHINA

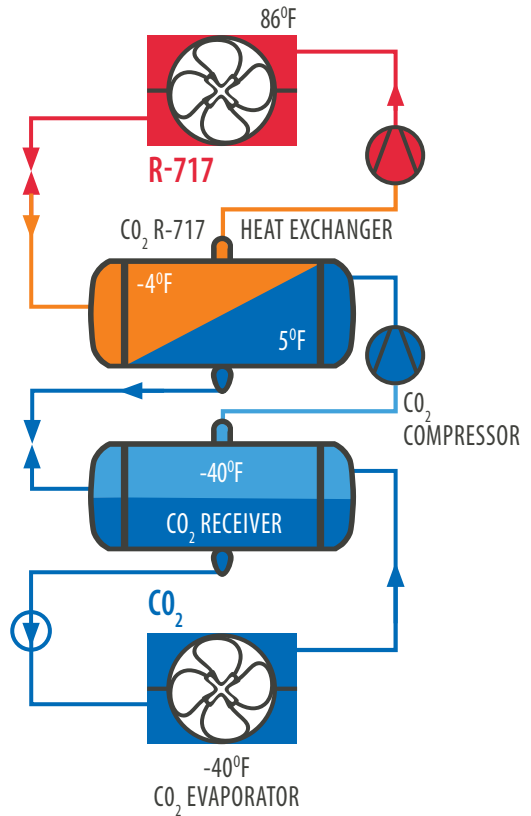


## COSTA RICA: Pre-Mezclas Industriales de Panaderia

The project was developed by Costa Rica and UNDP to demonstrate that Ammonia/CO<sub>2</sub> technologies can be safely deployed in the field in Latin America. These systems can result in better solutions for countries with limitations in the use of supercritical CO<sub>2</sub> in direct expansion or in countries operating under subcritical conditions, but mostly using the R-404a with reduced charges as a secondary fluid.

This project will allow the company to eliminate its HCFC usage and thus achieve another step required for the public plan of carbon neutrality and help the country reduce its HCFC consumption. The project uses a two stage Ammonia/CO<sub>2</sub> system where a reduced charge of ammonia is expected in the primary cooling circuit. Liquid CO<sub>2</sub> is circulated as secondary cooling, but at subcritical pressure, reducing the costs of installation and almost eliminating the associated risk with pressure. The two stage Ammonia/CO<sub>2</sub> system is expected to be mounted as per the following diagram:

This technology demands tighter controls, monitoring and maintenance practices for both refrigerants. Capacity needs to be built on such prerequisites to assure proper handling. The installation is designed to reduce leakage risks. However, even with risks reduced and smaller charges, ammonia is a toxic substance, and Costa Rica will invest in the adoption of appropriate technical guidelines and standards to enable conditions for its safe application and further replication of the project. The results of the project are expected to influence all levels of the supply chain (including support to make parts and knowledge on use available), training institutions and engineering universities in the country.



GENERAL VIEW OF THE FACTORY FROM THE PLATFORM WHERE THE EQUIPMENT WILL BE INSTALLED.  
PHOTO CREDIT: RODOLFO ELIZONDO



# Bangladesh

## Conversion from HFC-134a to Isobutane

### Walton Hi-Tech Industries

Walton Hi-Tech Industries has been at the forefront of exploring innovative HCFC conversion technologies. In 2014 Walton, with UNDP and MLF assistance, successfully completed the conversion of the insulation foam component to replace 183.6 metric tonnes of HCFC-141b by cyclopentane in domestic refrigeration manufacturing. At the time of the project approval, the capacity of the enterprise was about 283,000 manufactured refrigeration units/year.

Following a bilateral project with the USA implemented by UNDP to convert one production line using HFC-134a in 2015, in 2017 Walton is once again working with UNDP, to request MLF assistance for the conversion of three domestic refrigerator manufacturing lines and a compressor manufacturing facility all from HFC-134a to isobutane. The proposed

project, which is being submitted to the 80<sup>th</sup> Meeting of the MLF ExCom, will result in 197.30 metric tonnes of HFC-134a emission reduction in the manufacturing of refrigerators and 33.3 metric tonnes per annum of HFC phaseout in servicing.

The project is also expected to result in direct emissions reduction of about 282,000 tonnes of CO<sub>2</sub> eq. due to the reduction of 197.3 MT of HFC-134a. Special efforts will be made to increase female technician employment in the project. UNDP, the National Ozone Unit of Bangladesh and Walton will build on their past collaboration to make this HFC phaseout initiative as great a success as its collaboration to phaseout HCFCs, and to put Bangladesh firmly on the path to future compliance with the Kigali Amendment.



DISCUSSION ON THE CRANK SHAFT OF A R600A COMPRESSOR AT WALTON.  
PHOTO CREDIT: WALTON BANGLADESH



R600A REFRIGERATOR COMPRESSOR TESTING LINE AT WALTON.  
PHOTO CREDIT: ASHRAFUL AMBIA, EXECUTIVE DIRECTOR, WALTON

# Colombia

## Testing HFO/CO<sub>2</sub>/Water cost-effective combinations for discontinuous foam panels

### Espumlatex (system house) and ABC Poliuretanos (small company)

One key foam subsector in several developing countries that still uses significant HCFC-141b is the manufacture of discontinuous panels for the construction and commercial/industrial refrigeration industries. It has many SMEs who lack the capacity to handle flammable substances. This along with the lack of economies of scale prevents the adoption of hydrocarbons and results in the use of high-GWP alternatives such as HFCs.

HFOs are low-GWP and mildly-flammable options for HCFC and HFC used in the foam sector. Their performance is comparable, and in some cases better than HCFC-141b. However HFO cost and availability are the main barriers to its adoption. In 2015, this UNDP demonstration project tested HFO usage for discontinuous panels by developing PU foam formulations with reduced HFO content that have CO<sub>2</sub> – derived from the water-isocyanate reaction – as a co-blowing agent. The aim was to optimize the cost/performance balance while achieving a similar foam thermal performance to that of HCFC-141b based formulations.

A statistical design of experiment (DOE) has been set having as independent variables the type of molecule and the composition of the cell gas. The responses

(or dependent variables) will be the foam properties critical for this application (Lambda value, compression strength, dimensional stability, friability). The DOE looks to guarantee the replicability and validity of the obtained results.

A commercial HCFC-141b based formulation is used as control and new formulations using the two HFO molecules currently available – 1233zd(E) from Honeywell or Arkema and 1336maam(z) from Chemours – have been developed to obtain the desired composition of the cell gas, changing the level of HFO in the PU formulation, going from 100% HFO to 0% HFO (or 100% water), with intermediate compositions (80%, 60%, 40%, 20%).

Most formulations have been developed and lab tests are underway at Espumlatex, the main local system house in Colombia; field tests will be conducted at ABC Poliuretanos, a local company which represents a typical SME PU company in a developing country. The project should be completed by end-2017. UNDP and the Ministry of Environment and Sustainable Development will present a report to the MLF ExCom, and then an international workshop will share the results and findings.



FOAM PANEL TESTING AT ESPUMLATEX USING A BRETT MOLD.  
PHOTO CREDIT: ESTEBAN GARCÍA, ESPUMLATEX



# China

## Ammonia Semi-Hermetic Frequency Convertible Screw Refrigeration Compression Unit for Industrial and Commercial Refrigeration

### Fujian Snowman Company

Fujian Snowman specializes in the manufacture of integrated packaged refrigeration systems incorporating twin-screw refrigeration compressors, of open (ammonia) and semi-hermetic (HCFC-22) designs. The ammonia charge for open twin-screw compressor integrated package refrigeration system is greater than 100kg, and use of such a high ammonia charge is forbidden in densely populated areas.

This demonstration project will test a smaller system with a lower ammonia charge (under 50 kg.) with CO<sub>2</sub> as a secondary refrigerant. The product will be redesigned and constructed to fit the small discharge semi-hermetic frequency convertible screw refrigeration compression unit. In order to expand the application of ammonia in SME industrial and commercial refrigeration systems, a semi-hermetic style ammonia compressor will be used. Following standards, building codes and safety requirements, CO<sub>2</sub> will be used as the secondary refrigerant. This demonstration project will cover low-temperature applications and key project components would comprise: new compressor design, new heat

exchanger design, construction of the compression unit, manufacturing of prototypes, and construction of the test device.

The key elements in operationalization and commercialization would be the innovations needed to make the systems efficient and reliable by integrating system components and manufacturing in a factory-controlled environment. Following construction of the test device, the next step would be the design, production, marketing and debugging of the new product. Training of personnel will be critical. As this is the first demonstration for this particular application, provision has been made for construction drawing design, detailed compilation of construction materials used, instructions for installation and construction, and instructions on debugging operation. A work plan has also been provided for the market promotion needed for this new technology to enter the market.

This project would eliminate 359 tonnes of HCFC-22, would result in GHG emissions reduction of 1.04 million tonnes of CO<sub>2</sub> eq. and the partner institution is FECO/MEP, China.



COMPRESSOR UNIT ASSEMBLY LINE AT FUJIAN SNOWMAN CO. LTD., CHINA.  
PHOTO CREDIT: FUJIAN SNOWMAN CO. LTD





# Chile

## Transcritical CO<sub>2</sub> Refrigeration Systems

### Jumbo Supermarket in Valdivia, Chile

**Background** Chile is a partner of the CCAC (Climate and Clean Air Coalition), an initiative launched in 2012 by UN Environment and a group of countries, to promote collective action to reduce Short Life Climate Pollutants (SLCPs) such as black carbon, methane and HFCs. Chile, through its National Ozone Unit (NOU) in the Ministry of Environment (MMA), with technical assistance from UNDP, received a \$482,790 grant from CCAC to conduct the demonstration project “Strengthening technical capacity for the adoption of trans-critical CO<sub>2</sub> refrigeration system as alternatives to HFCs in the supermarket sector in Chile”.

Chile had very limited experience on the use of CO<sub>2</sub> as refrigerant fluid in RAC applications, and no experience in handling transcritical CO<sub>2</sub> technology. Chile is also very dependent on HFC-based refrigerants used in the supermarket sector which has four major chains – Walmart (through the brand Líder), Cencosud, Tottus, and SMU – which together represent 90% of the sector.

#### Project implementation and results achieved

An initial assessment of national needs to adopt transcritical CO<sub>2</sub> in refrigeration systems was conducted, followed by training on the application of transcritical CO<sub>2</sub> technology in the supermarket sector. A study tour

to Italy was organized comprising 4 senior engineers from supermarkets, 4 trainers from universities/training institutions, 3 local refrigeration experts, and the participation on technical congress in Brazilian International HVAC-R Exhibition and Congress on 2015 (Febrava/Conbrava) was organized to increase knowledge on this application. Furthermore, UNDP supports the exchange of experiences between foreign technology providers and local Chilean end-users in order to remove barriers to technology development.

As a result, the project was able to establish an agreement with the local supermarket chain “Jumbo” that had secured co-finance that has led to the installation of the first trans-critical CO<sub>2</sub> system in a supermarket in Chile, located in the city of Valdivia. The project was also able to scale up its results by transferring experiences that secured the installation of the second trans-critical CO<sub>2</sub>-based supermarket in Chile, funded partly by the Chilean HCFCs Phase-out Management Plan (HPMP) and the supermarket owner. Most important, both chains had committed to all new stores to be in the country shall use the trans-critical CO<sub>2</sub> systems, while 8 new stores running on transcritical CO<sub>2</sub> systems are expected to be inaugurated in 2018 in Chile.



TRAINING OF TECHNICIANS IN CHILE ON TRANSCRITICAL CO<sub>2</sub> TECHNOLOGY. PHOTO CREDIT: NATIONAL OZONE UNIT, CHILE



# TECHNOLOGY ADVANCEMENT

## Swaziland

### Replacing HCFC-141b with Cyclopentane in Refrigeration

#### Palfridge (The Fridge Factory)

Swaziland is a small, landlocked, low-volume ODS-consuming country which decided to make production of its refrigerators ODS-free and climate-friendly, and thereby become an example of sustainability in Africa.

The MLF ExCom approved the UNDP rigid foam conversion process from HCFC-141b to cyclopentane as a blowing agent which has zero ODP and low-GWP. The facility, located in Matsapha, produces around 350 units a day, of which 120 are domestic refrigerators. Palfridge exports to member countries of the Southern African Development Community (SADC) will also help those countries use non-ODS and low-GWP domestic and commercial refrigerators. Palfridge completely eliminated its use of HCFC-141b, thus helping Swaziland meet its HPMP Stage 1 HCFC phaseout target. The country has now banned the import of HCFC-141b.

This was not an easy project to implement. A challenge was the added safety equipment and procedures due to the use of cyclopentane –

additional gas sensors, emergency stop buttons, alarm boards, ventilation and fire detectors were installed, and the safety of the cyclopentane storage tank was confirmed by a safety audit following international standards.

With the support of GIZ/Proklima, Palfridge also converted its full line of domestic and commercial refrigeration appliances to hydrocarbon refrigerants (domestic fridges, commercial refrigerators for supermarkets and bottle coolers, solar refrigerators including a solar-powered vaccine cooler). In 2015, an awareness event was held by Palfridge to announce that all its production was 100 percent ODS-free, and in Oct. 2016 it was featured as a showcase project at a Side Event at MP MOP-28 in Kigali, Rwanda.

Through this cooperation between the Government, the international community and the private sector, it has been possible to generate and expand the number of green jobs in Swaziland.



FINISHING WORK ON FRIDGE DOOR PANELS FORMED USING CYCLOPENTANE AS BLOWING AGENT AT PALFRIDGE.  
PHOTO CREDIT: PALFRIDGE

# India

## Development of Low-Cost, Small-Capacity, Simple and Efficient Foaming Machines for SMEs

UNDP and India's Ministry of Environment, Forests & Climate Change developed a group project covering 122 SMEs in the foam sector to eliminate 639 MT ODP of CFC-11 in the manufacture of rigid foam products (e.g. general insulation, spray/in situ insulation, flexible and integral skin foam thermoware such as jugs, flasks, hot/cold cases) and well as in system houses. These SMEs were earlier using CFC-11 as blowing agents in inefficient and leaking foaming equipment. Although enterprises were aware about quality assurance and safety issues, due to their small-scale operations, limited resources, and to keep the product cost low, these enterprises continued using the older equipment. These 122 SMEs employed around 2,000 workers.

UNDP contracted a foaming machine manufacturer in India to develop customized low-cost small-capacity foaming equipment in collaboration with system suppliers (including an indigenous chemical supplier). The system houses designed the required CFC-free chemical formulations, to enable these SMEs to use the new CFC-free technology cost-effectively.

The new equipment was simple, economical, efficient and low maintenance to ensure long-term sustainability. Further economies in project costs were achieved through standardization of foaming equipment, bulk procurement and indigenization. Extensive technical assistance and training were provided to enhance SME capacity to address technical and environmental issues. The project was successfully completed.

This shows that through innovative approaches in project execution, it is possible to introduce cost-effective and sustainable technologies in SMEs and to enhance their long-term viability and sustainable livelihoods. The project received an Exemplary Project award from the Parties to the Montreal Protocol, on the occasion of the 20<sup>th</sup> Anniversary of the Montreal Protocol in September, 2007. India and UNDP are working together to find innovative solutions for SMEs to phaseout HCFCs in the foam sector under HPMP Stage-II based on the successful experience of CFC phaseout in foam sector SMEs.



INDIA SME FOAM PRODUCERS INSPECTING FOAM DENSITY AT HUACHUANG POLYURETHANE CO. LTD, SHAOXING, CHINA.  
PHOTO CREDIT: YUN WAN, UNDP CHINA

# UNDP-Designed Projects Minimize the Cost of Foam Conversion

## In Latin America/Caribbean

UNDP has been the main implementing agency in the foam sector for the phase out of HCFC-141b in Latin America and the Caribbean. After the approval of the HCFC amendment in 2007, demonstration projects were approved by the ExCom to validate the use of Methyl Formate and Methylal in Brazil and Mexico. Additional demonstration projects have been approved for Colombia for the use of Supercritical CO<sub>2</sub> in spray foam (with Japan) and HFOs in reduced formulations in the discontinuous panels sector. These projects have positioned UNDP as the lead implementing agency for the phase-out of HCFC-141b in the foam sector for the introduction of several low GWP options (HFO, Water/CO<sub>2</sub>, Methyl Formate, Methylal).

In the Multilateral Fund, UNDP introduced the concept of working through System Houses to reach downstream users (SMEs) in the foam sector. The first approved projects in the CFC phaseout era were in Brazil and Mexico. The system house develops and sells the foam systems and at the same time provides technical assistance to their clients, who are often small and unsophisticated companies with limited

technical and financial capacity. To work through System Houses has proven to be a very cost-effective and sustainable way to reach the small clients in A5 countries, and is based on the approach on building local capacity via training and technical assistance. The same approach is being used for the implementation of HPMPs and can be adjusted to implement the Kigali Amendment.

UNDP is currently implementing System House projects in Brazil, Chile, Colombia and Mexico in order to reach a large number of SMEs in these countries. The same System Houses export foam systems to neighboring countries, which has enabled UNDP to reach additional countries such as Cuba, the Dominican Republic, El Salvador, Jamaica, Panama, Trinidad and Tobago, Uruguay and Venezuela. All projects aim at avoiding the introduction of high GWP HFCs and strive to introduce the long-term solution immediately.



HAND TESTING PU FOAM SYSTEM AT COMSISA SYSTEM HOUSE IN MEXICO. PHOTO CREDIT: HORACIO HERNÁNDEZ DEL CASTILLO



BERT VEENENDAAL (INTERNATIONAL CONSULTANT) WITH TECHNICIANS AT POLIOLES/BASF SYSTEM HOUSE IN MEXICO. PHOTO CREDIT: HORACIO HERNÁNDEZ DEL CASTILLO



## In Egypt

UNDP has been involved with Egypt's polyurethane (PU) foam industry since the start of initial CFC phaseout programme, and the first ever PU foam project approved by the MLF was in Egypt. Currently, Egypt has an important PU foam industry dependent on new technological solutions related to the phaseout of HCFCs. This process was initiated jointly by Egypt and UNDP for non-appliance PU foam applications in 2010.

As a part of the overall approach, there was a low-cost hydrocarbon (n- and c-pentane) demonstration project designed and implemented to reduce capital costs for such processing equipment. The secondary objective was to assist system houses to pre-blend hydrocarbons (c-pentane being successful) to help their downstream users apply this technology option. This pilot project allowed mid-sized PU companies (25-30 metric tonnes of annual HCFC consumption) to access technology as compared to past practice of only larger firms being able to do so due to higher

safety costs. Once proven successful, this particular approach was proposed for HPMP implementation both in Egypt and worldwide.

Further, during Egypt's HPMP Stage I programme covering 2010-2018, MLF funded a number of stand-alone investment projects and system houses. Several individual programmes were completed with the use of methyl formate and pentane, allowing companies to stay competitive in the longer-run. And eligible system houses were assisted with conversions to non- HCFC , low-GWP options such as methyl formate, methylal or others based on parallel demonstration projects implemented by UNDP in Latin America. These alternative technologies become more solidly established in Egypt and with HPMP Stage II programme approved in 2017, Egypt's foam PU non-appliance sector will be fully prepared to transition to non- HCFC solutions with minimal negative impact on the climate.



USE OF PENTANE IN FOAMING OPERATIONS AT REFRUCK COMPANY, EGYPT.  
PHOTO CREDIT: THE PROJECT TEAM



# Mexico

## Options for the Substitution of HCFC-142b in the XPS Foam Sector

Under Stage I of Mexico's HPMP, a HCFC phaseout programme for the PU foam industry through its system houses was successfully completed. UNDP and SEMARNAT (Govt. of Mexico) then investigated whether any end users had been left out. Two larger producers of extruded polystyrene (XPS) plank foam for construction applications still using HCFC-142b were further identified.

Based on the available technology for HCFC phaseout in XPS foam, it appears that hydrocarbons, CO<sub>2</sub> (LCD) and HFO-1234ze have, by far, the lowest climate impact based on direct emissions (GWP of the gas) only. While HFC-134a reduces the global warming effect compared to CFCs, it will be disallowed in future in sectors where lower GWP alternatives exist and its use is therefore discouraged. A sustainable HCFC substitution program for XPS boardstock may therefore include hydrocarbons, CO<sub>2</sub> and HFO-1234ze. HFO-1234ze was selected as the most viable option as it has by far the lowest climate impact based on its GWP combined with acceptable physical properties.

The project is scheduled to start in 4Q2017. It is structured as a group project with two individual subprojects. Both subprojects share the same phaseout technology—HFO-1234ze/DME 60/40. HFO-1234ze requires the use of DME or another emulsifier to assure proper blending. As DME is (moderately) flammable, adequate safety precautions are required. Both companies use the same melting/blending/extruding process albeit in different grades of sophistication. UNDP has reflected all specific production issues given that the condition of pumps and screws is very important as DME is a very potent solvent and would maximize every leak, however small. The project document's budget also reflects these issues by including sufficient flammability safeguards.

The implementation of this HPMP component will phaseout the use of 167.97 MT of HCFC-142b at baseline conditions (2008) and thus contributes considerably to the phaseout of HCFCs in Mexico.



SPRAY FOAM TESTING AT URETHANE SYSTEM HOUSE IN MEXICO.  
PHOTO CREDIT: HORACIO HERNÁNDEZ DEL CASTILLO

# China

## ODS Phaseout in the Solvents Sector Covering Hundreds of SMEs

China's solvents sector includes enterprises from electronics, telecommunications, aviation, light industry, textiles, medical appliances, automobiles, precision instrument industries, etc., which all use ODS as solvents and some also produce ODS solvents. While solvents are a small percentage of China's total ODP, there are large numbers of ODS consumers. So ODS phaseout in the sector is essential.

China started with individual projects and by 1998, with UNDP assistance, had eliminated 710 ODP tonnes of CFCs in 18 enterprises. To cover the hundreds of smaller enterprises, a multi-year CFC Solvent Sector Phaseout Plan was developed in 2000 with \$52 million in MLF funding to phaseout CFC-113, CTC and TCA consumption at 3,200 users including many SMEs. This was done through 14 group projects, issuing bans, implementing quota systems and providing training and technical assistance. Every annual phaseout target during 2000–2010 was met, with 4,031 ODP tonnes eliminated as per China's agreement with the MLF ExCom.

Under HPMP Stage I, \$5 million was approved in 2011 with 610.3 tonnes of HCFCs eliminated in 9 enterprises by 2015. The remaining 400 enterprises located in 21 provinces and municipalities were covered under HPMP Stage II. The plan had a combination of interventions such as technology conversion investments, policies and regulations,

technical assistance, training, and public awareness. Iso-paraffin and siloxane (KC-6) technology in medical devices cleaning was successfully demonstrated and then widely adopted as a substitute for HCFC-141b. All investment activities were completed by end-2016, the remaining technical assistance will be completed by end-2017 with all funding disbursed.

The Stage II Solvent Sector Plan targets complete phaseout of HCFCs by 2026 in four stages using a combination of investment, technical assistance and policies and regulations to ensure sustainable phaseout and compliance. All HCFC use in the sector may be phased out four years ahead of schedule, with a reduction of GHG emissions of 11.30 million tonnes of CO<sub>2</sub> equivalent in total during the implementation period, and a reduction of 2 million tonnes of CO<sub>2</sub> equivalent annually after 2025.

As both the disposable medical device and electronics subsectors are labor-intensive with predominantly female workers, the replacement of HCFCs would reduce both the labour intensity and the chemical concentration in the workshop, thereby protecting worker health. As Lead Implementing Agency for both the HPMP and the solvent sector in China, UNDP has worked closely with FECO/MEP in the formulation and successful implementation of the Sector Plans to ensure the sustainable phaseout of CFC and HCFC consumption in solvents in China.



VISUAL INSPECTION OF CLEANLINESS OF MEDICAL DEVICE AFTER CLEANING USING NON-ODS SOLVENT.  
PHOTO CREDIT: FECO/MEP, CHINA

# AGRICULTURE/FISHERIES/HEALTH

## Maldives

### Testing HCFC-free Low-GWP Alternatives in the Fishing Industry

#### 1. HOW DID YOU BECOME INVOLVED IN THE PROJECT?

*As a project manager (MIFCO) I participated in Ozone unit meetings, later as engineering manager at 'Kan'duoyigiri fish village (MIFCO)' attended meetings and workshops conducted by Ozone unit through which our sector was represented.*

#### 2. HOW HAS BEING INVOLVED IN THE PROJECT IMPACTED YOU AT A PERSONAL LEVEL?

*It has improved my knowledge, and I was able to send my colleagues to the training programmes conducted by the National Ozone Unit which contributed to the capacity building of relevant staff.*

#### 3. WHAT IS YOUR PERSPECTIVE ON THE DEVELOPMENTAL IMPACT OF THE PROJECT?

*As an active participant of this programme, we are proud that we can achieve the government target to phaseout R22. We have created awareness amongst the refrigeration community, and through them, the locals.*

#### 4. YOUR PERSPECTIVES ON WHAT HAS WORKED WELL AND WHY?

*The willingness of those who work in the fisheries sector to go with the available retrofit at that time, and the financial help provided by UNDP through the Multilateral Fund.*

*Musthafa Rafeeu, Manager, Maldives Industrial Fisheries Company (MIFCO)*

The Maldives is a small island developing country, where the fisheries sector is one of the largest contributors to the economy and employs a significant population of the country. The fish catch of Maldives is stored, processed and exported globally. HCFC-22 is used predominantly in fishing vessels for processing and storage applications. Though aging, much of this equipment still has an economic life, and requires continued use of HCFCs for its operation. Since fishing vessels operate at sea and under rough weather conditions, it is difficult to control leakage and adopt good servicing practices, as compared to land-based HCFC equipment.

The project will identify and test HCFC-free low GWP alternatives to replace HCFC usage in the fisheries sector. In addition, technical information on retrofit and replacement technologies would be provided. This will assist Maldives in adopting technologies that promote low GWP low carbon growth, and could also be a good example to other smaller countries where the fishing industry is a significant HCFC user.

UNDP's Implementing Partner for this project is the National Ozone Unit, Ministry of Environment and Energy.



RECOVERY OF REFRIGERANT USED IN THE FISHERY SECTOR. PHOTO CREDIT: MIT AND NATIONAL OZONE UNIT, MALDIVES

# Sri Lanka

## Alternatives to Methyl Bromide for Eradication of Tea Nematodes

### Ozone Friendly Tea

Ahead of schedule, Sri Lanka phased out CFC, Halons, Methyl Chloroform, Carbon Tetrachloride, and Methyl Bromide (MeBr) usage in 2008. MeBr, however, was still used for quarantine and pre-shipment purposes as allowed under the Protocol. Under the project, Sri Lanka completely phased out use of MeBr in agriculture, including tea cultivation in 2009, well in advance of the 2015 target. UNDP's national partner was the Tea Research Institute of Sri Lanka.

From 1965, MeBr was used in Sri Lanka to kill tea nematodes, weeds and diseases from tea soils. Thanks to the project, the Tea Research Institute of Sri Lanka under the guidance of Ministry of Environment particularly National Ozone Unit and assistance of Sri Lankan Tea planters have successfully introduced a combination of chemical and non-chemical alternatives to MeBr, and ended the use of MeBr. All tea grown in Sri Lanka is now 100% ozone-friendly, bearing the 'Ozone Friendly Pure Ceylon Tea' logo which certifies ODS-free production. A group of MeBr alternatives were tested and accepted including organic amendments, biological control, screening of tea clones, soil substitutes and integrated pest

management. The project included public awareness raising, staff training and an international workshop to disseminate the results.

The Ozone Friendly Tea logo is an important value-added certification for this tea brand which has a \$1.5 billion market share. The Sri Lanka Tea Board registered the logo in tea importing countries in 2012. Leading tea manufacturers in Sri Lanka, in collaboration with Government and NGOs, also launched initiatives under the slogan 'Eco Friendly Tea Gardens' to minimize the use of chemical fertilizers and pesticides and to preserve the biodiversity in Sri Lankan tea plantations. In addition to phasing out toxic pesticides, Sri Lankan tea manufacturers are also seeking to reduce their carbon footprint by reducing energy consumption and opting for solar powered energy solutions.

Sri Lanka achieved the Implementer's Award from the Ozone Secretariat at the 20th Anniversary of the Montreal Protocol in 2007. This project is an example of choosing alternatives in keeping with local availability to protect the environment, safeguard human health and generate income for local populations.



NUWARA ELIYA TEA PLANTATION, SRI LANKA. PHOTO CREDIT: SRI LANKA TEA BOARD



THE "OZONE FRIENDLY PURE CEYLON TEA" LOGO WAS LAUNCHED IN MAY 2011.



# Bangladesh and India

## Alternatives for CFC Use in Metered Dose Inhalers (MDI)

### Partnering with business to improve environmental, human health and welfare

Asthma and chronic obstructive pulmonary disease (COPD) are the most common chronic diseases of the respiratory system and are estimated to affect over 500 million people worldwide. The preferred method of drug therapy for asthma and COPD employs medications that are delivered through the nose by means of a hand-held Metered Dose Inhalers (MDI). An MDI is a complex system designed to provide a fine mist of medicament, generally with an aerodynamic particle size less than 5 microns in diameter.

- The Bangladesh MDI project was approved by the MLF ExCom in July 2007 to phaseout 76.3 ODP tonnes of CFCs and transition Bangladesh to non-CFC MDIs.
- India's national strategy for transitioning to non-CFC MDIs and plan for CFC phaseout in pharmaceutical MDIs manufacturing was approved in Nov. 2008 to phaseout 704.03 ODP tonnes of CFCs.

These projects met the needs of both Bangladesh and India to transition to non-CFCs MDIs gradually without negatively affecting the health of asthma and COPD patients. The technology selection for both countries was based on ease of use by the patient and applicability to the local context and HFA technology, which retains the drug delivery mechanism.

The two projects shared various challenges and opportunities for UNDP to assist, including:

- Extensive search for a suitable propellant and propellants combination systems, excipients, toxicology, and study data to evaluate suitability.
- Non-ozone depleting hydro-fluoroalkane (HFA) inhalers must be primed more than the old CFC inhalers.
- Pharmacological concerns: Different mouth feel, taste, and alcohol content.
- Lack of consumer confidence in new products.
- Market barrier removal issues since CFC-free inhalers were twice the cost of their CFC counterparts.
- HFA-based inhalers, with sticky mist, need to be cleaned more often in humid tropical conditions.

The impacts of the MDI projects in Bangladesh and India went beyond national boundaries. The enterprises that participated in these projects developed state of the art manufacturing and testing facilities, which resulted in increased production capacities. Seminars and trainings organized for doctors and health professionals not only promoted non-CFC inhalers but also improved asthma and COPD treatment especially in the rural areas. Further, the CFC-free MDIs benefited the health sector both on the domestic side and export markets.





# DISTRICT COOLING

**District Cooling**<sup>11</sup> distributes cooling energy from a central source for air-conditioning in a district. It is a more efficient and sustainable alternative for urban development. “Cooling Districts” are centralized systems which produce cool and/or hot water to be distributed among different buildings in order to provide cooling or heating. All currently manufactured A/Cs work on the principle of the vapour compression cycle with refrigerants in a closed loop. HCFCs and HFCs traditionally used as preferred refrigerants in A/Cs over the past decades will be phased out. Not-in-kind alternatives which include vapour absorption systems, deep seawater cooling systems, tidal and other cooling systems in a district cooling configuration do not use conventional refrigerants such as HCFCs and HFCs. The multitude of energy sources used in not-in-kind alternatives potentially results in less energy consumption and lowering the carbon footprint.

## DOMINICAN REPUBLIC: Punta Cana District Cooling Feasibility Study

- The MLF approved a request for a feasibility study to develop a business model for district cooling in the Dominican Republic. The feasibility study will determine the technical and financial viability of the proposal. The feasibility study commissioned by UNDP and funded by the MLF was developed within the areas owned by The Punta Cana Foundation Group (Grupo Puntacana) which includes hotels, an international airport, a new shopping mall and a new hospital, taking into account future development in the area.
- The feasibility study was performed using a cost-minimizing perspective, and with a focus on bankability and financial performance of the District Cooling Project. The objective was to create a viable, reliable District Cooling product that is in line with international and local market expectations, energy efficiency improvements and refrigerant (HFC and HCFC) phase-out.
- The suggested District Cooling system is based on utilizing waste heat from the exhaust gases from electricity generation, and installing centralized

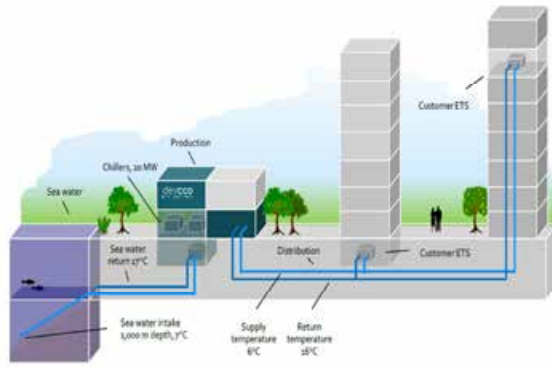


ILLUSTRATION OF PROPOSED 100 MW SWAC DISTRICT COOLING SYSTEM IN HULHUMALE, MALDIVES. ILLUSTRATION CREDIT: DISTRICT ENERGY VENTURE, SWEDEN.

large-scale absorption chillers to use the waste heat for cooling purposes. The chilled water would be distributed in a chilled water loop to each client within the area. This would potentially lead to a reduction in CO<sub>2</sub> emissions in the range of 80-90%. The technology is proven and has been used in Sweden, Denmark, and other countries for over 10 years. The final decision regarding the investment is still to be taken, but the technical and financial perspectives are very promising.

## MALDIVES: Hulhumale District Cooling Feasibility Study

- Maldives is implementing its HPMP and targets complete elimination of HCFC use by 2020. HCFCs in the Maldives are used primarily for air-conditioning and secondly for refrigeration. A feasibility study was done by Devcco for UNDP and the Government of Maldives, funded by CCAC, to evaluate options for district cooling that would negate the need for HCFCs and HFCs in future. It was found that planned developments in Hulhumale would generate a very large demand for cooling. Based on masterplan data, potential demand has been estimated at 300 MW cooling capacity and 1.8 million MWh of cooling energy every year.
- The feasibility study looked at several production technologies and found that a Seawater A/C system (SWAC) with a minimum installed chiller capacity can provide feasible and competitive district cooling in Hulhumale. Further from shore, the water temperature would be sufficient for a very

<sup>11</sup> [www.ccacoalition.org/en/news/district-cooling-promising-and-sustainable-option-move-away-hfcs](http://www.ccacoalition.org/en/news/district-cooling-promising-and-sustainable-option-move-away-hfcs)

efficient SWAC system. Closer to shore a hybrid system was recommended where sea water is used in combination with chiller to provide the desired temperature and capacity for the district cooling system.

- Since the Hulhumale developments will be brought on stream over several years, a 3-phase approach of 100 MW for each phase was recommended. When fully implemented, CO<sub>2</sub> savings of 426,000 tonnes/ annum could be achieved. The final decision regarding the investment is still to be taken, but the technical and financial perspectives seem promising.
- “We believe that this project is of particular importance to the Maldives and other Small island Developing States dependent on imported fossil fuels, because it helps us gain energy security and pave the path for a sustainable economy” said Mr. Mauman Abdul Rasheed of the Government of the Maldives.

### **COLOMBIA: District Cooling in the “La Alpujarra” district in Medellin**

During 2013 an Agreement was signed between the National Ozone Unit (NOU) and Medellin’s Public Companies (EPM - Empresas Publicas de Medellin, the electric utility of the city of Medellin) in order to finance the design of the “La Alpujarra” cooling district. EPM is a public company that provides electricity, gas, water service as well as garbage collection. EPM is the second biggest public services company in Colombia, with 75% of its clients located in urban areas and 70% in warm climate zones. EPM has identified specific cooling needs for their clients at the Administrative Complex of “La Alpujarra”, which is composed of many buildings (such as the Antioquia Province City Hall, The City Council, The Province Assembly, the Tax Revenue Authority, the Customs Authority, and the Tigo-UNE Telecommunications Utility, among others) that were using individualized chillers-cooling systems, which were very energy intensive.

The demonstration project supported development of a technical and financial viability study to cover the design of a thermal district that could offer a complete “cooling service” instead of only electricity to these clients. Based on this study, an inter-agency cooperation agreement was signed that mobilized \$14 million from external and domestic sources. The project started operating in late 2016 and is now providing 3,600 refrigeration tonnes of capacity.

The cooled water is produced using climate friendly technologies (ammonia and absorption systems) and it is distributed by a system of tubes throughout 1.5 km in the neighbourhood. UNDP provided the initial technical assistance and gave \$500,000 to EPM as seed capital; this led to resource mobilization from the Swiss Government as well as from EPM.

The main energy source for the centralized District Cooling system is natural gas. Secondly, energy captured from the burning of waste (waste heat) is used in a turbine to produce cooling and thereby reduces the demand for Natural Gas. Thirdly, during low peak hours (mainly during the night) ice is being produced for the ice bank, which in turn is being utilized during the day for the cooling of water. This combination makes the system efficient and reduces demand for electricity in peak hours. The whole District covers Governmental buildings that have a high demand for cooling during the day. The district has been designed in a way that allows for future expansion in demand (e.g. to cover more buildings). The estimation is that EPM has reduced CO<sub>2</sub>-emissions by almost a third with the introduction of District Cooling.

### **COSTA RICA: District Cooling Workshop (May 2017)**

In May 2017, Costa Rica and UNDP organized a workshop in San Jose to raise awareness on the potential to introduce the concept of district cooling into the country. The workshop had over 60 participants. UNDP had invited international experts on District Cooling from Sweden (DEVCCO) to facilitate the workshop. The participants included local government authorities, utilities, water and electricity distribution companies, potential district cooling owners/developers, potential district cooling end-users, and finally associations related to the A/C sector in the country. The main aim of the workshop was to raise awareness among key stakeholders on the environmental and financial benefits of district cooling, combined with the identification of potential pilots for future work on district cooling including the international airport (Juan Santamaria), several hospitals and tourism complexes. Follow up work is already planned in the context of the Kigali Cooling Efficiency Programme (K-CEP), where funding has been approved for the development of a national District Cooling Strategy combined with the full development of feasibility studies for the most suitable sites with the aim to introduce the first District Cooling project in the country.

# TECHNICIAN TRAINING & CERTIFICATION Malaysia

## eCSTP (e-Certification Service Technician Programme) in HPMP Stage 1

The Certification Service Technician Programme (CSTP) started during National CFC Phaseout Plan. The online system e-CSTP started in 2016. The programme promotes awareness among technicians, especially on the environmental impacts of refrigerants and promotes good practices during servicing to prevent accidental leakages. It is conducted by the Authorized Training Centre (ATC) comprising government and private institutions with refrigeration and A/C schools. The programme was made mandatory through legislation in the Environmental Quality Act (Refrigerant Management) Regulations, which requires service technicians to be certified prior to handling refrigerant in the servicing sector. An online system was designed to allow a technician to get information on training schedules, training registration, access to training materials and examinations. The Department of Environment awards technicians who have passed the exams a certificate and a technician card with a QR code which can be verified by scan on any android phone.

The project provides an online reference of a Standard Procedure for all Authorized Training Centres; monitors and collects data related to the eCSTP training organized by ATC; provides systematic reporting for future reference and enforcement purposes; and serves as a platform for an online repository database that contains all eCSTP information and names of technicians certified by eCSTP.

The Department of Environment uses the system to plan, monitor, verify and approve eCSTP activities. The system is also accessible to the ATC to provide training

and conduct exams; and ultimately to the public to verify authenticity of technician certification and gain access to related technical information.

### ACHIEVEMENTS/IMPACTS:

- Close collaboration between Ministries is key to the success of establishing the ATCs in Malaysia.
- Currently, there are 51 ATCs. In 2016, there were 97 Master Trainers trained to run the CSTP programme and 2,351 service technicians certified through the programme.
- The certificates ensure service technicians competency and expertise in refrigerant handling. The certificates are also a passport for more job opportunities and better pay.
- “The CSTP programme provided a better job opportunity to technicians in Refrigeration and A/C Servicing Sector. The certificate from the Department of Environment helped me secure a job in one of the Japanese companies, and I am currently based in Japan. The certificate gives confidence to the international employer as it is proof of my competency and professionalism in this sector.” – Indra Irawan Bin Idrus, Certified Technician. Indra is now working on servicing and installation of air conditioner in Japan with Seimei Engineering.



SAMPLES OF THE CERTIFICATE AND A TECHNICIAN CARD.  
PHOTO CREDIT: NATIONAL OZONE UNIT, MALAYSIA



INDRA IRAWAN BIN IDRUS, CERTIFIED TECHNICIAN AND NIK ISMADI, THE MASTER TRAINER. PHOTO CREDIT: NATIONAL OZONE UNIT, MALAYSIA

# Trinidad & Tobago

## Certification for Refrigeration and Air-Conditioning Technicians

In partnership with UNDP and the National Ozone Unit, the National Training Agency has developed a Professional Certification Course for Air Conditioning and Refrigeration Technicians. Following a request from the Air Conditioning and Refrigeration Industry Association (ARIA) for the certification of technicians in order to have better regulation of the Refrigeration and A/C Sector, the National Ozone Unit (NOU) approached the National Training Agency (NTA) on possible collaboration in establishing such a system based on the National Guidelines Document developed by the NOU.

The NTA indicated that it would include this Professional Certification in its work programme, and a team was established comprising NTA, the NOU and key stakeholders in the sector, including the School of Refrigeration and Air Conditioning (SORAC), Metal Industries Company Limited (MIC),

National Energy Skills Center (NESCC), and the Youth Training and Employment Partnership Programme (YTEPP), to develop this Professional Certification. Consultations were held and the proposal revised accordingly. The System was built based on input from all stakeholders and is administered by the NTA. The system for certification covers three specific areas within the Refrigeration and A/C industry: (a) Residential; (b) Commercial; and (c) Mobile/Automotive

The first edition of Trinidad And Tobago's first refrigeration and air conditioning Certification Scheme can be found at: [www.ntarestore.org/images/PDF/RABOK%204.6new.pdf](http://www.ntarestore.org/images/PDF/RABOK%204.6new.pdf)



TRAINING AS PART OF THE RAC TECHNICIANS CERTIFICATION PROGRAMME.  
PHOTO CREDIT: NATIONAL OZONE UNIT, TRINIDAD AND TOBAGO

# Uzbekistan

## Servicing Technician Training in the Refrigeration and A/C Sectors

Galim Gabbasov from Navoi, is a young, active participant of the training organized by project of the State Committee of Uzbekistan for Ecology and Environmental Protection, UNDP and GEF on HCFC phaseout in Uzbekistan. At age 27, he heads the service center for repairing and maintenance of household appliances.

"I am glad that previous respect for the profession of refrigeration technician is reviving", said Galim during his training. "Thanks to the Refrigerant Recovery and Recycling Center created in Navoiy city, we are now able to collect and reuse all chlorine-containing types of refrigerants and thus reduce the import of ODS and prevent their unintended release into the atmosphere. In addition, our Center has a license for servicing 13 known brands of refrigeration equipment such as Samsung, KÖNIG Electronics, LG, and Haier. We not only maintain the equipment but also protect the environment".

Over 700 refrigeration sector engineers/technicians have been trained in 12 regions, the Republic of Karakalpakstan and Tashkent city. Over 90 public and private enterprises engaged in refrigeration equipment servicing, now have modern equipment and tools to improve the quality of services meeting international standards. Five HCFC Recovery and Recycling Centers and one HCFC Reclaim Center were established.

Five technicians from public and private enterprises working in refrigeration and A/C installation, repairing and maintenance, as well as lecturers from Tashkent State Technical University, participated in the training at the International Training Center "Galileo", Italy, in Sept. 2015. During 2016-2017 they themselves acted as national trainers and conducted local training for refrigeration specialists in the regions of Uzbekistan. This allowed the transfer of know-how and accumulated knowledge.

Dilshod Azizov, head of the department of "Refrigeration and Cryogenic Engineering" of Tashkent State Technical University says that one key project achievement was development and publication of handbooks for refrigeration technicians and specialists such as "Basics of Refrigeration Engineering and Maintenance of Refrigeration Systems" and "Use of Propane as an alternative to HCFC 22 in refrigeration and air conditioning equipment". These handbooks are the first-ever on refrigeration engineering written in the Uzbek language. The handbooks include up-to-date information on refrigeration equipment, present technical characteristics of modern equipment for refrigeration and A/C systems, and main provisions for their operation. Some chapters are devoted to alternative refrigerants and their characteristics and environmental impacts.



TRAINING OF LOCAL SERVICING TECHNICIANS IN SAMARKAND AND HANDBOOK ON BASICS OF REFRIGERATION ENGINEERING AND MAINTENANCE OF REFRIGERATION SYSTEMS. PHOTOS CREDIT: UNDP UZBEKISTAN



# SOUTH-SOUTH COOPERATION

## India-China

### Technology Discussions/Exchanges in the Foam Sector

Under HPMP Stage II, India is expanding its conversion process to phaseout HCFCs in over 400 SMEs covering a range of foam products and technologies. China's experience in the use of HCFC alternatives in the foam industry inspired a study tour from India to exchange experiences on technology for phasing out HCFC in polyurethane (PU) foam, which was jointly organized by UNDP's China and India Offices from 14-18 August 2017. Fourteen Indian participants were on the study tour, which covered four Chinese cities – Beijing, Yuyao, Shaoxing and Haining. The tour had three components: a workshop, talks on HCFC phaseout technology, and plant visits.

**Learning by talking** On 14 August 2017, participants from India, China's Foreign Economic Cooperation Office (FECO) staff, and technical foam experts from China attended a workshop at FECO in Beijing. The workshop covered presentations from experts on alternatives to HCFCs and discussion on phaseout technology including the flammability and cost-effectiveness of alternatives. Participants were able to compare the "pros and cons" of HCFC alternatives, an exercise useful to future decisions on using alternatives in both China and India.

**Learning by asking** During 15-17 August, study tour participants went on field visits to five foam

enterprises in Zhejiang province who use HCFC alternate technologies. By directly communicating with those enterprises' experts and asking them questions, participants learned about enterprise technology, challenges confronted, and solutions to those challenges.

**Learning by seeing** In addition to exchanging ideas and knowledge at the table, study tour participants visited five enterprises with assembly lines of water heaters and refrigerators and other equipment using HCFC alternatives in the insulation foam. Several participants had hands-on practice spraying and cutting foam blocks to have a close look at the foam composition to see how water-expanding foam is made and how effective its insulation is.

"The study tour to China is meaningful and I have learnt a lot," said one participant. "An excellent initiative by UNDP and India's Ozone Cell to keep our planet precious. I salute UNDP's commitment and hats off to you all. Had a great experience and this is an unforgettable study tour. We also have new good friends from industry" said another participant.

UNDP hopes to continue to facilitate similar study tours for knowledge and technology exchanges between countries.



INDIA STUDY TOUR PARTICIPANTS OBSERVING FOAMING WITH HYDROCARBONS AT NINGBO SHUAIKANG WATER HEATERS CO. LTD., CHINA. PHOTO CREDIT: YUN WAN, UNDP CHINA



INDIA STUDY TOUR PARTICIPANTS AT SHAOXING HENGFENG POLYURETHANE INDUSTRY CO. LTD. CHINA. PHOTO CREDIT: YUN WAN, UNDP CHINA

# Brazil

## South-South Cooperation to Promote Low-carbon Refrigeration Technologies in LAC

In 2013, the Brazilian RAC Association, ABRAVA, sponsored the 18th Technical Congress and Exhibition on Heating, Ventilation, Air Conditioning and Refrigeration in São Paulo, which brought together technology developers and suppliers from all over the world. UNDP sponsored a booth and invited national ozone officers from Chile, Colombia, Costa Rica, Dominican Republic, Jamaica, Paraguay and Uruguay as well as Portuguese-speaking African countries (in partnership with UNEP) to attend the event and access the latest information on state-of-art technologies to replace HCFC-22.

The invitees reviewed field application of ODS-free and low carbon technologies such as CO<sub>2</sub>, NH<sub>3</sub> (ammonia) and hydrocarbons in several manufacturing and servicing sectors. UNDP organized back-to-back seminars with major technology providers and fostered bilateral discussions between suppliers and governments to discuss alternative technologies and policies for practical implementation

of HPMPs. Field visits to local companies were organized to demonstrate the practical application of the alternative technologies.

The ideas discussed and contacts made during the Exhibition resulted in other pilot/demonstration activities currently being implemented. Among the lessons learned were:

- South-South cooperation requires information dissemination and technology transfer, so countries can assess technologies and situations similar to the ones that national ozone officers face in their countries;
- Lower project and country-related costs can be achieved if local and regional experts are identified and if the new technology is manufactured in the region and/or country.



TESTING OF CFC RECYCLING BAGS.  
PHOTO CREDIT: ANDERSON ALVES, UNDP/MPU



UNDP TRAINING SEMINAR IN HCFC-FREE, LOW-CARBON TECHNOLOGIES IN REFRIGERATION FOR NATIONAL OZONE OFFICERS FROM LAC AND AFRICA.  
PHOTO CREDIT: MARINA RIBEIRO, UNDP/BRAZIL

# Malaysia

## HPMP Consultative Workshop in the Foams Sector

UNDP is lead implementing agency for Malaysia's HCFC Phaseout Management Plan (HPMP). Under HPMP Stage I, 13 large enterprises in the foam manufacturing sector adopted alternative technology which resulted in the phaseout of 94.6 ODP tons of HCFC-141b. In the ongoing HPMP Stage II, Malaysia will phaseout HCFC-141b in the foam sector by covering SMEs. Finding suitable alternative technology for SMEs in the foam sector is a challenge for Malaysia, as well as other Asian countries. The Malaysia HPMP II includes 67 enterprise whose consumption ranges from 0.2 MT to 76 MT of HCFC-141b.

In order to create awareness in the industry about alternative technology, to build the capacity of system houses and to address technology-related issues that enterprises have, Malaysia and UNDP organized a consultative workshop with international foam experts in Kuala Lumpur from 21-23 August 2017. The event included a one-day workshop, and two days of site visits. The selection of 20 enterprises for the site visits was based on their size, applications used and geographical coverage.

International experts made presentations on alternative technologies in the foam sector to phaseout HCFC-141b with about 50 foam industry owners and system houses participating. The workshop helped foam users understand different alternatives and the global scenario. Participants also discussed various aspects of the alternatives with the experts. The workshop concluded that Malaysia system houses will need more support to try different formulations of alternatives to enable them to adequately support SMEs. UNDP and the Government will build the capacity of the system houses through expert training.

At the end of the 3-day workshop, there was a meeting between UNDP, the Government and the experts to draw up a roadmap to continue further support to industry in phasing out of HCFCs. UNDP plans to continue organizing similar expert meetings in future to facilitate exchanges between countries.



GOVERNMENT OF MALAYSIA AND UNDP PARTICIPANTS AT THE SEMINAR LAUNCHING HPMP STAGE II IN MAY 2017.  
PHOTO CREDIT: THE GOVERNMENT OF MALAYSIA

# GENDER ASPECTS

## Peru

### Training Women on RAC Good Practices

Since 2016 Peru has been conducting workshops for RAC (Refrigeration and A/C) technicians. While the workshops were successful, few women in the RAC business participated. So the National Ozone Unit and UNDP conducted a workshop on RAC good practices and handling of natural refrigerants for women only. Fernando del Castillo Uribe, UNDP consultant and specialist in RAC, conducted the workshop and said: “It was very interesting to have a workshop exclusively for women RAC technicians, most with practical experience, and who welcomed being trained in these new technologies. In our experience, women who are dedicated to RAC are very detail-oriented – activities that require fine motor skills such as for electrical wiring. They are also very careful in following all safety guidelines, especially important with flammable new refrigerants”.

A workshop participant, Iris Vega Valverde, said in 1982 she decided to pursue a RAC career at an institute in Chiclayo in northern Peru. “When I studied I had only

one female classmate, the others were men. Today the RAC sector is essential for the lives of millions of people around the earth with many specialties”.

Peru is complying with the HCFC phaseout schedule, implementing an import authorization system for the entry of HCFCs into the country and a programme to raise awareness and training for technicians. RAC technicians are of vital importance since they have to maintain the equipment and prevent leakages. Unfortunately, educational institutions that teach this topic in Peru advertise technical courses in a way to capture the attention of men. Through images that include only men, schools discourage women from participating. The 35 female participants were very satisfied with the trainer who answered all their questions and advised them in practical exercises. Participant reviews at the end of the workshop will help organizers replicate the workshop in Peru and in other LAC countries.



WORKSHOP FOR WOMEN ON RAC GOOD PRACTICES AND HANDLING OF NATURAL REFRIGERANTS.  
PHOTO CREDIT: ALFREDO QUEZADA, MINISTRY OF PRODUCTION



# El Salvador

## Strengthening the Administrative Capacity of Women to Run SMEs

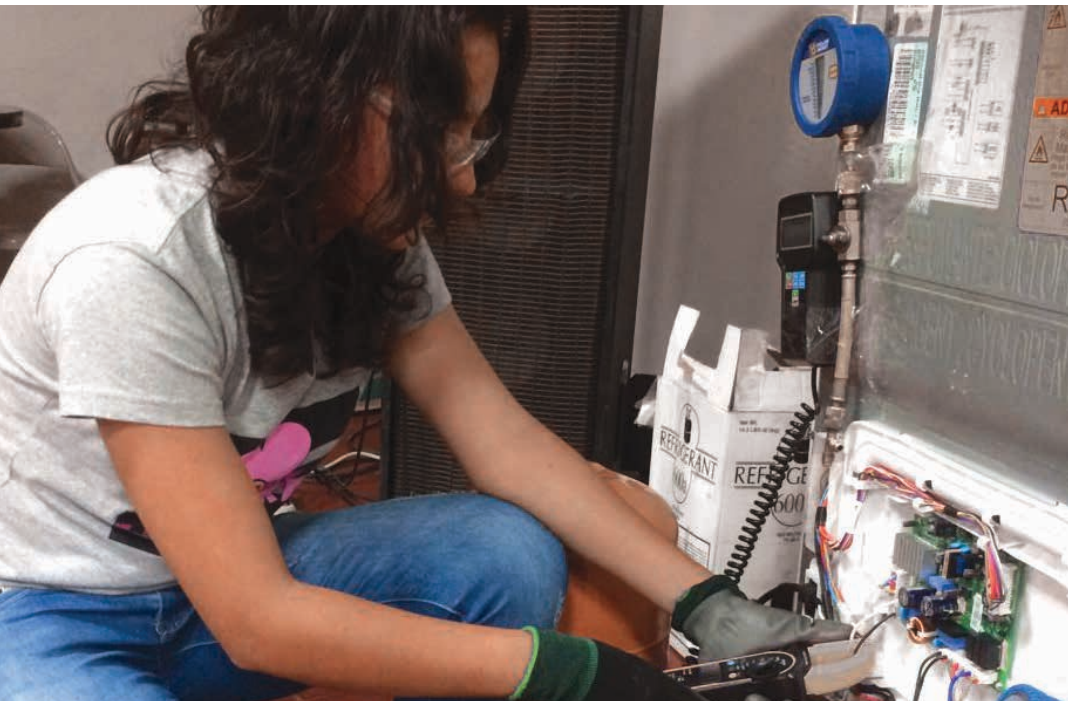
Under HPMP Stage 1 implementation of the “*Training of technicians in good refrigeration practices and alternatives to HCFCs*”, the National Ozone Unit found that several male technicians arrived accompanied by their spouses. When asked why, it was discovered that many spouses handle the administrative work for their technician husbands, making them “maintenance service microenterprises”.

Considering that women are very sensitive to care of the environment, the Ozone Unit and UNDP designed a training workshop for the spouses of refrigeration technicians, training them in administrative issues such as financial management and basic marketing, what their technician husbands are doing to protect the ozone layer, and how adoption of alternative substances and good practices can improve the finances of the family business by:

- Identifying the savings that can be generated by avoiding the emission of refrigerant gas into the atmosphere.

- How to identify new business opportunities by working with alternative substances and technologies.
- How to promote their microbusiness by highlighting their good practices to protect the environment.

This seminar was held in October 2017, as part of the celebrations in El Salvador on the 30<sup>th</sup> Anniversary of the Montreal Protocol. The example of El Salvador shows the importance of thinking about different approaches to promote the protection of the environment and that the Montreal Protocol provides opportunities to improve the quality of life of populations.



A FEMALE TECHNICIAN ATTENDING THE TRAINING ON GOOD REFRIGERATION PRACTICES.  
PHOTO CREDIT: RUBEN BONILLA



# PROMOTING ENERGY EFFICIENCY AND ODS PHASEOUT ACROSS FUNDS AND AGENCIES

UNDP has a \$2.8 billion portfolio in the field of climate change and energy spanning 140 countries. This includes programmes under the Global Environment Facility (GEF), Green Climate Fund (GCF), UN-REDD and several others. Areas of focus include climate change mitigation and adaptation, forests and cross-cutting initiatives. Many projects deal with energy efficiency and sometimes in the same sector that the MP MLF works in – such as refrigeration and air-conditioning. When new energy-efficient equipment is being procured, this is an opportunity to also eliminate the use of CFCs, HCFCs or HFCs. There are several examples of such synergies within the UNDP portfolio and a few are mentioned below.

UNDP also works with other UN agencies, the World Bank and bilateral agencies in the joint formulation and implementation of individual projects and sectoral programmes for the phaseout of CFCs, HCFCs or HFCs in recipient countries. A few examples follow below:

## Ghana

### Promote Appliance Energy Efficiency and Transform the Refrigeration Appliances Market (MLF, GEF and UNDP)

Between 2011 and 2014, Ghana undertook a programme with UNDP support to promote appliance energy efficiency, under the leadership of the Energy Commission, in close coordination with the NOU (Ghana EPA). It quickly became a flagship programme due to strong support and coordination between stakeholders. *Independent evaluation reports indicate that it delivered demonstrable sustainable market transformation for energy-efficient refrigerators and freezers.* Funding came from the GEF, MLF, UNDP and the Government. The MLF approved a demonstration project to replace CFC-using refrigerators and freezers, which was used as co-financing for the larger GEF programme.

The accelerated phaseout of inefficient refrigerators was the result of the turn-in and rebate scheme, which provided incentives to consumers to return their refrigerators and obtain a discount on purchasing a new efficient model. The programme was fully financed by Ghana. The scheme partnered with retailers (who sold appliances and collected old ones still in working condition), banks (which processed the rebate vouchers and provided consumer loans) and the private sector to dismantle the old refrigerators. As of 2016, 7,257 refrigerators were replaced under the rebate scheme, with a further 25,000 illegally imported used appliances collected for safe disposal, bringing the total to around 32,000.

The Energy Commission and EPA handled the recovery of ODS through an office at the dismantling facility. The scheme was launched in coordination with the ban on imports of second-hand refrigerators. Refrigerators seized by Customs were also safely discarded in the same way. Collected ODS were destroyed in compliance with the Montreal Protocol, through export and high-temperature incineration.

A testing laboratory was set up for the monitoring and enforcement of Standards and Labelling for refrigerators and freezers. It is located at the Ghana Standards Authority. When appliances arrive in the country improperly labelled, they are tested. More than 20 retailers and importers have tested their appliances in the laboratory.

Through this, Ghana managed to replace its old stock of energy-inefficient CFC-using refrigerators – thus jointly benefiting climate and the ozone layer while saving energy.



EMPLOYEE AT CITY WASTE MANAGEMENT COMPANY LIMITED PROPERLY DEGASIFIES A REFRIGERATOR BEFORE ITS DISMANTLING. PHOTO CREDIT: THE PROJECT TEAM

# Belarus

## Testing Low-GWP Natural Refrigerants to Replace HCFC-22 While Increasing Energy Efficiency at Santa Bremor (GEF)

The private enterprise “Santa Bremor” is one of the largest producers of high-quality food products in Eastern Europe. For 20 years, it has been a leading domestic producer and a very recognized brand of fish products in Belarus and other countries. The company has about 5,000 staff, promotes environmentally-safe production, and takes measures to reduce its environmental impact. Processing of fish products requires significant electricity, hot water, steam and refrigeration.

Climate control in production departments had utilized HCFC-22. The Ministry of Natural Resources and Environmental Protection supported the replacement of HCFC-22 through use of an absorption refrigerating machine (ARM). GEF provided \$155,000 to the company through UNDP to introduce the new technology, eliminate HCFC-22 use, and help Belarus meet its obligations under the Montreal Protocol. The environmental benefit of the cooling technology is ensured by the use of natural refrigerant (water) in

the ARM. Today, the Santa Bremor energy complex based on ARM is a demonstration platform for the popularization of such technologies in Belarus.

In the summer, there is a large excess of heat and the demand for cooling is around 1.2 MW. The ARM transforms the waste heat into cold air. The produced cold water is used in the A/C system of two facilities to produce red fish delicacy and ice cream with a total area of 9,200 sq. mt. Absorption cooling technologies save up to 1,148,000 kWh of electric energy/year in comparison with compressor refrigeration units. This is sufficient to provide electricity to 640 private homes throughout the year. On 15 April 2016, Santa Bremor Company (in Brest) held a grand opening of the upgraded energy complex based on the ARM. Thanks to the new technology, over two seasons (2016-2017), the ARM reduced GHG emissions by 707 tonnes of CO<sub>2</sub> equivalent and reduced electricity consumption by 1,750,000 kWh.



GENERAL VIEW OF ENERGY COMPLEX “SANTA BREMOR” IN BREST, BELARUS. PHOTO CREDIT: VALERY PISHCHIK



ABSORPTION REFRIGERATING MACHINE (ARM) – HEART OF THE ENERGY COMPLEX. PHOTO CREDIT: VALERY PISHCHIK

# Cuba

## Demonstration of Energy Efficient CFC-free Technologies to Replace CFC Chillers (MLF, Canada and UNDP)

In 2005, as part of the initiative of the Montreal Protocol to tackle the chillers sector in developing countries, UNDP and Canada jointly supported the development of the demonstration project for integrated management of the centrifugal chiller sub-sector in Cuba, focusing on application of energy-efficient CFC-free technologies for replacement of CFC-based chillers.

The project replaced old, CFC-based, high energy consuming chillers in key institutions in Cuba with energy efficient, state-of-the-art CFC-free chillers from the Canadian company Smardt. The project included training of maintenance technicians of the beneficiary institutions on the new equipment operation. Canadian and MLF funds were used for the acquisition of equipment and Smardt provided all the training as its in-kind contribution, conducting 7 training workshops which trained 65 technicians. UNDP's national counterparts were the Ozone Office in the Ministry of Science, Technology & Environment, and the Ministry of Health

Although, it was originally planned to replace some equipment and retrofit other units, after the initial evaluation it was determined that all chillers had to

be replaced due to their old age and inefficiency to achieve the energy efficiency goals of the project. The recipient institutions were the National Theater, the Radioactive Isotopes Centre CENTIS (a laboratory that produces substances for cancer treatment) and 5 regional hospitals (with capacities between 320 and 850 beds). 9 CFC-based chillers were replaced in those 7 public institutions with state-of-the-art HFC-134a based chillers.

Training of staff was a key component to ensure maximum benefits (efficiency, energy savings) of the new equipment as different operational and maintenance approaches were required. Maintenance crew in each institution and technical staff of the Ozone Unit were trained. Most of the chillers were installed during 2008-2010; however the project was officially completed in 2013. The benefits of the project reach beyond the protection of the ozone layer. Thanks to the project, patients and medical personnel of the beneficiary hospitals now have constant and reliable air conditioning, especially in key areas such as surgery rooms, nursery rooms and intensive care units while saving valuable resources in maintenance and energy bills.



OLD AND NEW CHILLERS AT SANTA CLARA HOSPITAL.  
PHOTO CREDIT: CARLOS ANDRÉS HERNÁNDEZ, UNDP MPU



GENERAL HOSPITAL AGOSTINHO NETO, GUANTÁNAMO CITY.  
PHOTO CREDIT: CARLOS ANDRÉS HERNÁNDEZ, UNDP MPU

# Tajikistan

## More-efficient HCFC Usage in A/C Applications (GEF)

Interview with Mr. Tahir Shermatov, representative of Babilon-Mobile, a local mobile operator, who works with Base Transceiver stations (BTS) in the remote mountains. His main task is to ensure an appropriate temperature range at BTSs for their uninterrupted operations.

During 2015-2016 under the UNDP-GEF project, through close collaboration with Tajik mobile operators (Babilon-Mobile, Megafon and Tcell), demonstration projects were implemented in the A/C sector that aimed at reducing equipment failure and repair rates at relay stations and towers of cellular phone network providers. Moreover, the new equipment would significantly reduce HCFC imports for existing A/C equipment in the country. A total of 33 demonstration projects were successfully implemented throughout the country, increasing energy efficiency and reducing ODS emissions.

*Mr. Shermatov: I was quite surprised with the performance of the equipment. Regardless of the harsh climatic setting in our country this equipment showed a high level of efficiency.*

Mr. Shermatov said that, on average, equipment energy efficiency under the UNDP/GEF project is now 64% in southern provinces and 70-90% in the northern/eastern provinces. Post-implementation monitoring was carried out together with the servicing companies as well as UNDP engineers and revealed that 1 station equipped with the equipment might save up to 9,000 kW/h of electricity and reduce CO<sub>2</sub> emissions by over 10,000 kg in a year.

There are around 5,000 stations in the country and large-scale deployment of this equipment would result in energy savings up to 44,67 million kW/h. In terms of CO<sub>2</sub> equivalent reductions, it would be approximately 50,000 tonnes per year. Return on investment is between 2.5 and 3 years. Mr. Shermatov noted that during one full year of the new A/C equipment operation, servicing costs decreased 55-65%, the A/C equipment lifespan increased by over 40%, and HCFC leakage was significantly reduced (up to 60%).



INSTALLATION OF THE ENERGY EFFICIENT COOLING MODULE AT MOBILE BASE STATION.  
PHOTO CREDIT: UNDP TAJIKISTAN



# Indonesia

## Supporting the HCFC Phaseout Management Plan (MLF, Australia, UNDP)

To facilitate sustainability of phaseout actions, a bilateral cooperation component, “Product Stewardship Programme” was built into Stage I of the HCFC Phaseout Management Plan (HPMP). This would strengthen Government capacity for sustained compliance with Montreal Protocol guidelines through liaison and dialogue on policy and regulatory actions required to achieve sustainable refrigerant management, thereby contributing to the overall objective of HCFC phaseout in the foam, refrigeration, air-conditioning and servicing sectors in Indonesia.

The Australian bilateral cooperation has three main components: (a) Awareness and information outreach; (b) Training and capacity building; and (c) Policies and regulations for the service sector. Specific activities include:

- The refrigerant handling code of practice of Australia and New Zealand was translated into Bahasa Indonesia and used as a basis for preparing manuals for the A/C servicing code of conduct.
- A safety guide on flammable refrigerant was translated into Bahasa Indonesia.
- A concept note on national standards for safety and environment requirements in the installation of refrigeration systems is being prepared.

- A web-based Application of the Refrigerant Monitoring Tool (MAWAS) was developed with the technician association to meet their need to facilitate registration and reporting of their servicing activities and to enable the National Ozone Office to collect data to design targeted training activities and technician certification.
- Existing regulations on the provision of “Technical Guidance and Competency Requirement for Retrofitting and Recycling of RAC Systems” is undergoing review and, based on this review, a new concept note for a Ministerial Decree on “Safety Guidance and Competency Requirement for RAC Systems” will be developed.
- ISO 817 2016 was also translated into Bahasa Indonesia, was discussed among the participating institutions and was proposed to be adopted as the National Standard of Indonesia by the National Standards Agency.

This bilateral cooperation has leveraged knowledge to strengthen capacities and to facilitate the sustainability of HCFC phaseout efforts in Indonesia. UNDP worked very closely with Australia in effectively assisting Indonesia in all the above activities.



WEB-BASED AND MOBILE APPLICATION OF REFRIGERANT MONITORING TOOL (MAWAS) AND GUIDANCE FOR REFRIGERANT HANDLING. PHOTO CREDIT: NATIONAL OZONE UNIT, INDONESIA

# A LOW ODS VOLUME CONSUMING COUNTRY'S ONGOING SUCCESS

## Lebanon

### An Example of ODS Phaseout Across Sectors While Building National Capacity



Lebanon's commitment to international environmental treaties - especially the Montreal Protocol which was ratified by Govt. in 1993 - has resulted in new and additional opportunities for building a sustainable enviro-industrial alliance, a main pillar in national policy. Lebanon has taken significant steps to phaseout ozone depleting substances (ODS) under its Institutional Strengthening project through which its National Ozone Unit (NOU) was established in 1998 in the Ministry of Environment. UNDP has been the main partner for Lebanon in implementing all projects and programmes.

The NOU built a close partnership with the industrial sector through conversion of their manufacturing facilities to ozone-friendly production, enhancing their technical expertise and the properties of their newly manufactured products, creating new green jobs and helping the companies promote their products internationally. This has created an environmental culture that goes beyond MP-related matters. The trust built between the public and private sectors and with industrialists has helped raise environmental awareness, leading to more-effective national environmental-industrial planning, thereby supporting environmental sustainability.

Lebanon is a Mediterranean country with a population of 4.4 million. About 80% of the population is urban and the key economic sectors are services (~60% of GDP), industry (~26% of GDP) and agriculture (~14% of GDP).

### Portfolio of MLF-supported projects in Lebanon (as of Nov. 2017)

SECTOR	# OF PROJECTS	BUDGET (US\$)	ODS PHASEOUT (TONNES)
RAC <sup>12</sup>	72	3,535,000	376
Foam	22	2,800,000	415
Aerosols	8	1,395,000	480
Halons	1	70,000	7
Methyl Bromide	2	4,400,000	257
Non-Investment <sup>13</sup>	15	2,250,000	-
<b>Total</b>	<b>120</b>	<b>14,450,000</b>	<b>1,535</b>

<sup>12</sup>Refrigeration and Air-conditioning Sectors

<sup>13</sup>Non-Investment projects include institutional strengthening, and other technical assistance.



YOUNG PARTICIPANTS DURING THE OZONE SCIENCE DAY EXHIBITION. PHOTO CREDIT: NOU LEBANON



DISTRIBUTION OF UV BRACELETS TO SCHOOLCHILDREN. PHOTO CREDIT: NOU LEBANON

Lebanon is now in the process of ratifying the Kigali Amendment. With CFCs, Halons and Methyl Bromide successfully addressed, generations will only know about them from the history books. The NOU – since 1998 and through different implementation phases – has built-up the technical know-how of local industry and farmers by implementation 120 investment and non-investment projects, has built and supported local networks, and has focused on capacity development, awareness raising and communication outreach programmes.

MP-MLF support to the ODS manufacturing enterprises in the RAC, foam, aerosols and halons sectors strengthened enterprise capacities to meet ODS phaseout challenges and the resulting products were able to compete better in international markets. The successful introduction of alternatives to methyl bromide (soil solarization and ozone friendly chemicals, integrated pest management, grafting) resulted in better methyl bromide-free crops. Farmers' cost of fumigation decreased by 50%, opening the door to international markets (strawberry and flowers exported to Europe and other countries).

Lebanon has been very proactive in MP activities; CFCs, halons and methyl bromide were phased-out completely before 2010, HCFC phaseout is on the track, and some conversion projects completed in 2014 promote accelerated HCFC phaseout in different sectors.

The NOU supported awareness activities by creating national partners within the private sector, and this creative initiative injected additional funds into the awareness programme which allowed for larger-scale production of awareness materials which were then utilized in campaigns throughout Lebanon.

The NOU has also played a pivotal role in enhancing cooperation between the Government of Lebanon, and the Ozone Secretariat, the MLF Secretariat, the Implementing agencies and the MP ozone family at large.

Drawing on the key outcomes of the successful implementation of ODS phaseout activities over the past 20 years and through its strong in-country, regional and international presence supporting the protection of the ozone layer and combating climate change, Lebanon has demonstrated that collective multilateral efforts can indeed have substantial impact on the environmental, economic and other threats facing mankind.

The above strategy has allowed for the timely implementation of different activities in various sectors, all done in a fully coordinated and forward-looking strategy. This has enabled Lebanon to meet – or exceed – all its national MP ODS compliance targets. This is a good example for other smaller ODS consuming countries worldwide.



TRAINING OF AC TECHNICIANS IN VOCATIONAL SCHOOLS.  
PHOTO CREDIT: NOU LEBANON



**EQUIPMENT SUPPORT AND TRAINING PROGRAMS TO RAC SECTOR AND VOCATIONAL SCHOOLS** (10 vocational centers, 60 servicing workshops and more than 1,000 technicians):



**FOR EVERY \$1 INVESTED** on awareness activities through the project, **LEBANON MOBILIZED \$1.15** from the private sector.



**THE NOU WAS RECOGNIZED** with "The Montreal Protocol Implementation Award in 2007" and "The Policy and Implementation Leadership Award in 2017"



**REGULATORY LEGISLATION** in place banning the imports of CFCs, Halons , MeBr, as well the necessary legislation to ban imports of HCFCs before 2030



**COMPLIANCE WITH HCFC 2013 AND 2015 TARGETS AND THE PROJECTED 2020 MP CONTROL MEASURES** (1,212 MT in 2012 to 884 MT in 2015 to 550 MT in 2020)

# LOOKING FORWARD

- **UNDP will continue supporting recipient countries in their efforts to meet their HCFC 2020 and 2025 phaseout targets.**
- **Countries include both MLF and GEF countries which are eligible for assistance, as well as countries UNDP works with under other funding arrangements (e.g. CCAC, K-CEP).**
- **UNDP will strive to overcome difficulties on the technology side related to enterprise conversion especially in SMEs**
  - Challenges faced by SMEs in adopting the newer technologies due to availability, affordability and market penetration of new products and servicing issues.
- **UNDP will assist recipient countries in how they market the newer technologies**
  - In several developing countries, safety standards have to be revised to deal with the new alternatives which are often flammable (with different classes of flammability).
- Other countries may need special-order parts such as compressors which do not currently exist and would need to be manufactured.
- Innovative approaches need to be developed to handle the increasing training needs in the servicing sector due to the new technologies being introduced.
- UNDP will support developing and CEIT countries in the uptake of new low-GWP technologies, helping them resolve pending issues in the A/C sector such as performance in high ambient temperature conditions, low market penetration of new products, and affordability-related issues, as well as new initiatives using not-in-kind technologies such as district cooling.
- **In the context of the Kigali Amendment, UNDP would**
  - Assist client countries, on request, in their ratification process for the Kigali Amendment.



PHOTO AT THE HIGH LEVEL EVENT ON RATIFICATION OF THE KIGALI AMENDMENT TO THE MONTREAL PROTOCOL AT THE UNITED NATIONS, NEW YORK, SEPTEMBER 2017. PHOTO CREDIT: THE MINISTRY OF ENVIRONMENT OF RWANDA



- Assist countries, on request, in the development of their national strategies.
- Assist countries, on request, in their efforts to collect and analyze the relevant data.
- Continue and enhance UNDP's leadership role in HFC alternative demonstration projects and disseminate lessons learned.
- Continue and enhance support to recipient countries in their Enabling Activities and in Pilot and Demonstration projects.
- Continue supporting the energy efficiency thrust of the Kigali Amendment by linking more closely to synergistic opportunities within the MLF and other funds such as GEF and K-CEP, as well as government institutions, energy efficiency organizations, regional development banks, utilities, ESCOs and power distribution companies.
- Continue support to countries, on request, in their efforts to meet their Nationally Determined Contributions (NDCs) under the Paris Agreement.
- Assist countries, on request, integrate their HFC phaseout plans with their energy efficiency plans in MP industrial sectors.
- Continue active participation in K-CEP and other energy-efficiency related programmes.
- Enhance working partnerships with bilateral agencies, energy efficiency institutions, international, regional and national funding bodies and with the private sector.
- Continue to promote South-South cooperation and technology/experience exchange.
- Continue to closely follow new technology-related issues, aware that the uptake of new low and lower GWP alternatives compared to those currently available in the A/C sector in developing countries still present difficulties to be addressed. Continued support from the MLF through its implementing agencies would be crucial to helping countries keep the momentum and progress on refrigerant transition focused on the long-term MP objective including its Kigali Amendment.





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**Multilateral Fund**  
for the Implementation of the Montreal Protocol



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United Nations Development Programme  
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New York, NY 10017

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