

MONTREAL PROTOCOL AND BEYOND

17 STORIES ALONG THE JOURNEY FROM OZONE PROTECTION TO SUSTAINABLE DEVELOPMENT

This publication was written by Ana Acuña Dengo, with the support of Franziska Menten and Irma Lizde, and the technical inputs and creative contributions of the Montreal Protocol Division at UNIDO: Adnan Atwa, Ailsa Eidet, Bettina Schreck, Elena Miceva, Ester Monroy, Francesca Polenghi, Fukuya Iino, Giada Papi, Jude Sentongo, Katharina Nieschalk, Laura Reynaldo, Marie-Solange Fuchs-Mutazigwa (Materials and Chemicals Management Division), Milan Demko, Mirjana Ilijin, Nil Oezhan, Ole Nielsen, Regina Vellmer, Rodica Ivan (Materials and Chemicals Management Division), Rodrigo Serpa, Yunrui Zhou and Yury Sorokin. Special thanks to our consultants in the field: Alan Yeates, Andrei Pinihin, Artem Kushnerev, Judith Atim and Natasha Kochova for your contributions.






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FOREWORD BY STEPHAN SICARS

MANAGING DIRECTOR
ENVIRONMENT AND ENERGY DIRECTORATE AT UNIDO

The 2030 Agenda for Sustainable Development and the 17 Sustainable Development Goals (SDGs) embody the global commitment to build a more sustainable future for all. These universally agreed objectives address the most urgent environmental, social and economic challenges of our time. The SDGs are ambitious – including the eradication of extreme poverty and world hunger – but also measurable and actionable, with specific targets to be achieved by 2030. The Goals are broad, but also interconnected, recognising how achievements in one sphere can bring about progress in another. Achieving food security and improving healthcare both contribute to the eradication of poverty; climate action helps protect ecosystems and human health; and fostering peace and inclusive societies translates into progress towards a more sustainable global economy. With just under 10 years left to meet these ambitious targets, world leaders have called for a “Decade of Action” to deliver the Goals.

The United Nations Industrial Development Organization (UNIDO) sees industry as a vehicle to accelerate sustainable development and achieve the SDGs. An inspiring example of this is the role industry has played in achieving the ever more ambitious targets of the **Montreal Protocol**.

This is where our journey begins: with the Montreal Protocol and the global commitment to protect the Earth’s ozone layer. It all started in the 1970s, when scientists discovered that the ozone layer was under threat from a group of chemicals known as **ODS**. ODS had become key components in major manufacturing sectors and global trade goods, including refrigerators, air conditioners, foam and aerosol sprays, fire extinguishers and pesticides. Recognising the vital role of these sectors and their reliance on ODS, the international community understood that it would take decisive and global action to phase out these substances. From this determination the Montreal Protocol, regulating the production and consumption of ODS, emerged as the first treaty in the history of the United Nations to be signed by all 193 Member States*.

In 1992, UNIDO joined the frontline, as an implementing agency of the **MLF**. Since then, the Montreal Protocol has transformed industries around the globe, eliminating particularly harmful chemicals, and from early on, accelerating progress in many other fields. This includes - of course - industrial development, but also technology transfer, vocational training, food preservation, transport safety, institutional capacity development, various aspects of trade issues, transparency, south-south co-operation and others. The impact of the Montreal Protocol on so many aspects beyond ozone protection has made it particularly relevant for the 2030 Agenda for Sustainable Development and its 17 SDGs, which, since 2015, have inspired and driven decision-makers worldwide to take transformative action, individually and collectively, for people, planet and prosperity.

A great example of this is the adoption of the Kigali Amendment in 2016 to phase-down **HFCs**, which have a minimal effect on ozone depletion, but major global warming impacts. Recognising the contribution of HFCs to climate change, the Parties to the Montreal Protocol adopted the Kigali Amendment, thereby expanding the scope of the treaty towards more ambitious climate action.

As the Montreal Protocol has become more ambitious, so has the work of UNIDO, guided by the 2030 Agenda and our mandate of inclusive and sustainable industrial development. This calls for industry to contribute to sustainable development in all its dimensions: social, economic and environmental. UNIDO has helped industries transform their linear production models of “take, make, dispose” to the circular economy approach of “reduce, reuse, redesign, remanufacture, recycle, and recover”. Together, we have also taken on ambitious socio-economic goals, from gender equality to youth empowerment, promoting a role for everyone, irrespective of age, gender, race or disability.

UNIDO works with governments to develop and

enforce the policies and regulations needed to address these environmental and social challenges. Working hand-in-hand with industries, UNIDO is also well positioned to help companies put these policies into action. With the Decade of Action on the SDGs gaining momentum, it is time to look back and see how far we have come. On our journey, we have seen a transformational shift in the industrial sector and inspiring examples of industry’s contribution to the SDGs.

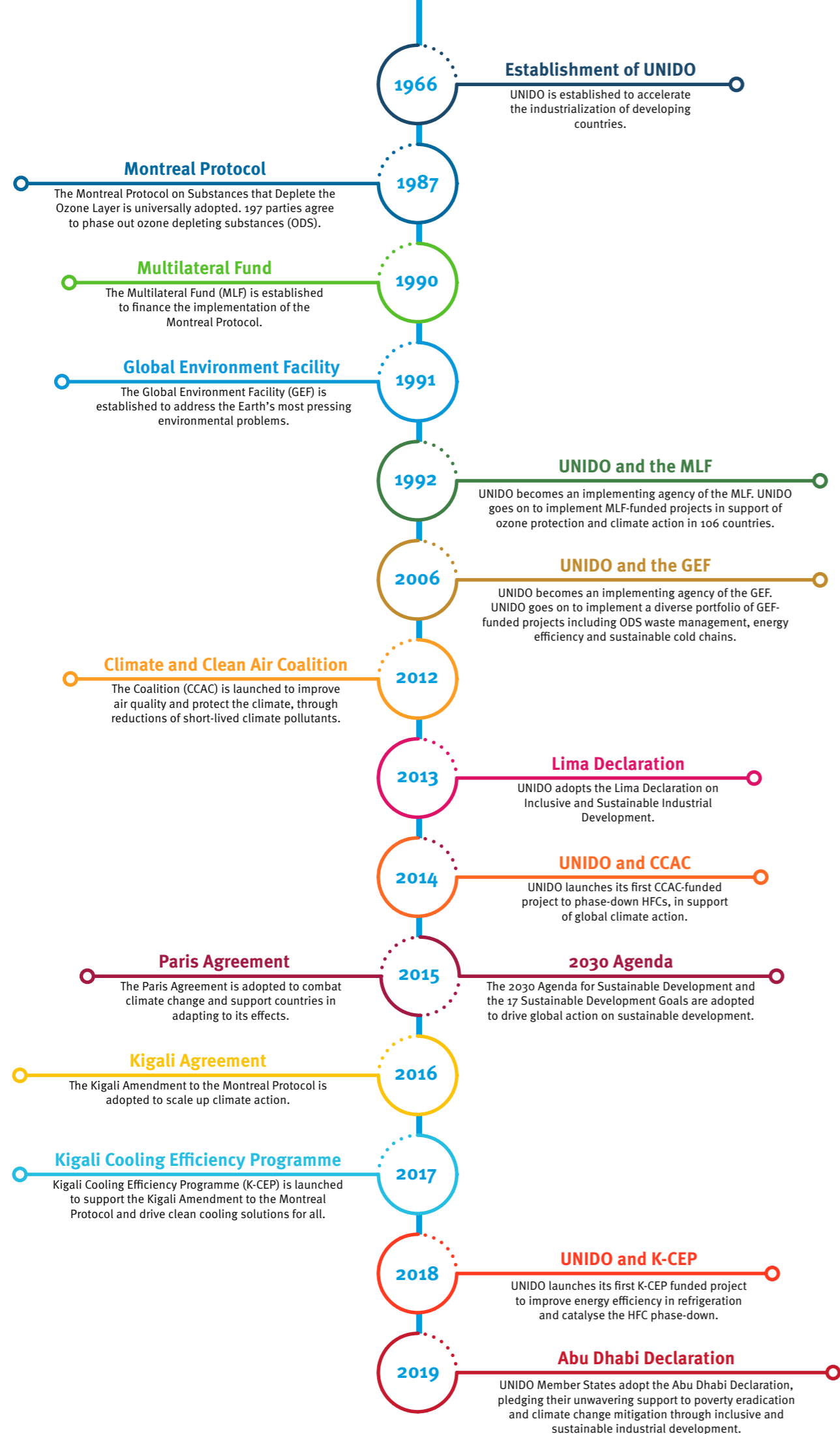
This publication is a collection of stories that celebrate the changing face of industry, reflecting on how the efforts supported by UNIDO to improve the environmental performance of the productive sector, have brought about sustainable solutions to other global challenges. This work is broad in nature, engulfing a multitude of stakeholders, from governments and industries to employees

and consumers. It is innovative in pioneering new technologies and approaches, to find the best-suited alternatives for companies, sectors and countries. Most importantly, this work goes beyond the phase-out and replacement of chemicals. As shown in this publication, these efforts can have a wider impact on our societies and a ripple effect on sustainable development.

The success of each project – and every story featured in this publication – is a result of the extraordinary dedication and coordinated action of many stakeholders. This exemplifies how our efforts, when well coordinated and decisively implemented by governments, industry, entrepreneurs and the general public, can bring us all closer to a world in which economic development, environmental sustainability and social inclusion are all valued and, ultimately, achieved.



* The Montreal Protocol has been ratified by all United Nations members, as well as Niue, the Cook Islands, the Holy See and the European Union.



INTRODUCTION

The 2030 Agenda for Sustainable Development and the 17 **SDGs** carved out a definitive role for industry in Goal 9: “Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation”. This recognises some of the major contributions of industry to modern society, but also invites us to consider industry’s wider role in driving sustainable development. If we apply each SDG as an individual filter, we can look at industrialization from 17 different lenses and appreciate the ever more ambitious role of industry on the global agenda.

UNIDO’s Montreal Protocol Division was born out of a global call for action to address the threat of **ODS** emissions from industrial activities, to people and the planet. This commitment, embodied in the **Vienna Convention** and the **Montreal Protocol**, has transformed key manufacturing sectors, from refrigeration and air-conditioning to agro-industry and healthcare.

Since 1993, UNIDO has worked hand-in-hand with industries and institutions to phase out 65,186 **ODP**-tonnes, substituting each ton of ODS with a less harmful substance or a new process. While institutions have played a major role in developing and enforcing the necessary policy framework, the industries we work with have taken on the challenge of redesigning their products and manufacturing processes, so that they are compatible with non-ODS alternatives.

In this time, the work of our Montreal Protocol Division has become more ambitious, engaging a broad coalition of institutions, associations and development partners, in support of wider sustainable development goals. Our growing portfolio of cold chain projects, in cooperation with the **GEF**, recognise the vital role of cooling for food processing, storage, and food security – major stepping stones on the path to ‘Zero Hunger’. New initiatives to find energy-efficient alternatives to ODS and high **GWP** refrigerants, in cooperation with the **CCAC** and the **K-CEP**, build on global efforts to promote energy efficiency, so as to limit greenhouse gas emissions and meet the targets of the Paris Agreement on climate change. The core of our work, funded by the **MLF**, has also evolved, from

ozone protection to climate action. By this means, we continue to mitigate the environmental impacts of industry, to protect the terrestrial and marine ecosystems that are critical for human development.

This publication celebrates the changing role of industry in response to global calls for action and the bold and transformative measures we have seen in each of the countries we work in, condensed into one story for each SDG. The stories are based on real-world experiences: the challenges that needed to be overcome, the advances that were made and the drivers behind each project. As such, they are only a snapshot of what we do - within a larger and growing portfolio of UNIDO projects - and who we work with.

Only a handful of our valued partners - industries, associations, governments and donors - feature in these stories. However, we see this publication as an homage to every individual we have worked with, and will continue to work with, to drive inclusive and sustainable industrial development. We are certain there will be many more stories to tell.



NO POVERTY

End poverty in all its forms everywhere.

Poverty presents itself in many forms. With the Earth's temperature rising across the globe, cooling is emerging as a basic need to protect low-income households from extreme heat. Cooling is also a big concern for emerging economies, as heat-related illnesses impact labour productivity and well-being.

With rapidly expanding markets and middle-class growth in Asia, the pressure is on to find sustainable cooling solutions. The region is home to five of the world's most populated countries facing climate hazards and cooling-related risks: Bangladesh, China, India, Indonesia and Pakistan.¹ Due to a multitude of socio-economic factors, including population density, poverty levels and dependence on agriculture, these countries are some of the most vulnerable to the direct and indirect impacts of climate change.

[View SDG 1 Targets](#)



In Pakistan, the air-conditioning market is growing steadily, alongside public and private investments in infrastructure.

Now the challenge is to find clean and efficient cooling solutions, so that we can protect the most vulnerable, without causing serious environmental impacts or accelerating climate change.

To meet this challenge, the Government of Pakistan, UNIDO and [UNEP](#) are working directly with local air-conditioning manufacturers, to change the future of cooling in Pakistan.

The most common refrigerant used in air-conditioning equipment in Pakistan is HCFC-22 (or R-22). HCFC-22 is an [ODS](#), with a high [GWP](#). This means that air-conditioning systems that rely on HCFC-22 play a part in damaging the Earth's ozone layer and contributing to climate change.

There are many promising alternatives to HCFC-22 on the market, but manufacturers cannot simply replace one refrigerant with another. They generally need to redesign their appliances, purchase additional equipment and adopt new maintenance practices. Under the [HPMP](#) for Pakistan, UNIDO is helping local manufacturers find suitable alternatives and put them into practice.



Dawlance, a Pakistani enterprise that produces 119,000 air-conditioning units per year, opted to switch from HCFC-22 to climate-friendly R-290 – better known as propane.

UNIDO is helping Dawlance redesign their models, mount a new refrigerant charging board and install additional safety equipment, including gas detection and ventilation systems and new leak detectors. UNIDO is delivering training on servicing practices and safety inspection, taking into account propane's flammability.

Training is an important component of the HPMP for Pakistan, and follows a 'train-the-trainer' model, so that qualified experts can go on to train other technicians in the servicing sector. This not only contributes to skills development and job creation, but is also an important step to phase-out HCFC-22. The servicing sector in Pakistan is mostly made up of small workshops employing one or two technicians and is characterized by seasonal workers. During the high-season for servicing (in the summertime), the small workshops consume around 20 kg of HCFC-22 per month, and larger workshops, with more than two technicians, consume around 40 to 50 kg of HCFC-22.

Service technicians play an important role in keeping cooling systems in the country running, particularly smaller units in low-income households. The train-the-trainer programme is giving them the skills to improve their services, but also their employment prospects.

By the same token, industry leaders like Dawlance are increasing their competitiveness by adopting sustainable business models. The key players in Pakistan's HPMP are not only protecting vulnerable members of society from heat exposure, but also driving economic growth and job creation. By this means, they are helping pave a path out of poverty.

These activities are being carried out in the framework of the [HPMP](#) for Pakistan, funded by the [MLF](#).

HPMPs are sector-wide programmes designed to help countries reduce their use of HCFCs, which destroy the earth's ozone layer and contribute to

greenhouse gas emissions. Each HPMP is unique and funding received from the MLF allows UNIDO to implement a wide range of activities in support of ozone protection and climate action. In 2020, the MLF approved 18.3 million USD of funding for UNIDO projects around the world.



ZERO HUNGER

End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

Zero hunger. To grasp the enormity of this goal, we have to look at the entire food supply chain and understand the journey from farm to fork. This journey along the cold chain – an uninterrupted series of temperature-controlled environments to transport, stock and distribute food - begins with cold storage. Annual food loss worldwide, due to inadequate cold storage and poor cold chain management, amounts to 475 million tonnes of food. This could feed up to 950 million people a year.² This much is certain: without effective and reliable cold storage, we cannot achieve zero hunger.

Cold storage units regulate temperature and humidity, to ensure the quality and safety of our food. Maintaining a consistently low temperature is particularly important for deterring the growth of bacteria and preventing food-borne illnesses, which affect 600 million people a year worldwide.³

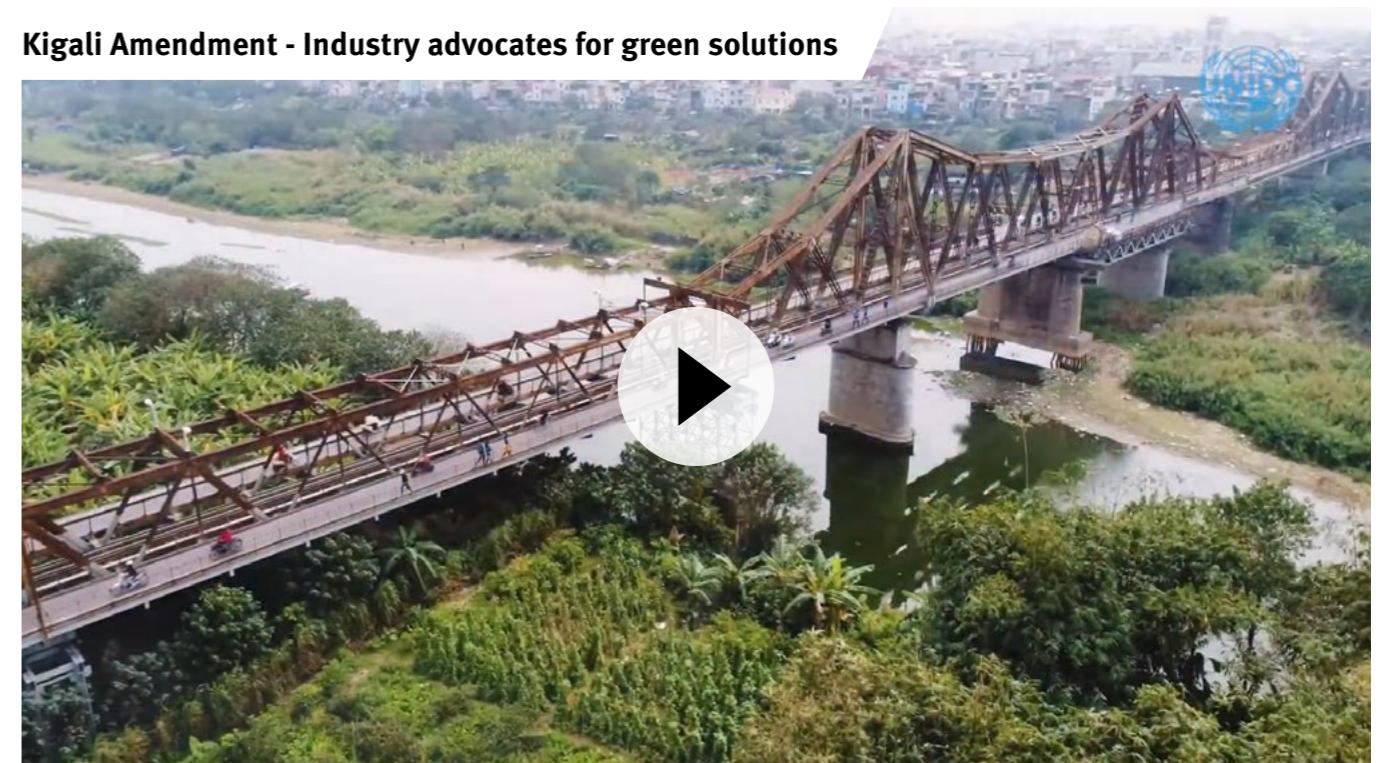
[View SDG 2 Targets](#)

In Viet Nam, cold storage is a critical component for the rapidly growing aquaculture sector. Approximately 3.4 million people (or 4% of the population) derive their income directly from aquaculture and capture fisheries.⁴ An even greater percentage of the population is involved in processing, trading of fishery products and related activities. If their products do not make it to market, they suffer economic losses.

From a socio-economic perspective, cold storage is vital for reducing food loss, increasing food security and protecting the livelihoods of producers. From an environmental perspective, cold storage poses some challenges, as cold chain logistics account for 11% of the world’s electricity consumption⁵ and rely on refrigerants, many of which have a high **ODP** or a high **GWP**. In this sense, the challenge is two-fold: how can we establish sustainable, climate-friendly cold storage to help us deliver safe and nutritious food across the globe.



Kigali Amendment - Industry advocates for green solutions



In Viet Nam, there are around 400 cold storage facilities used in the fisheries sector, all dependant on HCFC-22, a potent greenhouse gas. Most facilities have an average of 10 refrigeration machines running on HCFC-22, amounting to approximately 4,000 cold storage units for this sector alone. The majority of cold storage equipment is manufactured domestically, using second-hand compressors and unit coolers. With this outdated equipment, many storage facilities suffer from inefficient energy use and significant refrigerant leaks, of up to 20 – 25% of the total refrigerant charge contained in the units. This not only poses a concern for food safety, but also for the environment, when considering the greenhouse gas emissions from refrigerant leakage.

Recognizing the growing importance of this sector and the alarming levels of greenhouse gas emissions produced by the existing cold storage facilities, the Government of Viet Nam partnered with UNIDO, to change the landscape. The ultimate aim of this project: to transition to hydrocarbon-based refrigerants, with zero ODP and a low GWP. First, UNIDO and the Government of Viet Nam set

out to develop the ‘enabling environment’ for the adoption of hydrocarbon refrigerants. That is to say: the policy, legal, and regulatory measures to control the use of HCFCs and promote the use of climate-friendly refrigerants. Then, it was time to engage the private sector, with pilot projects in 4 regions of the country: Ho Chi Minh city, Hanoi city, Vinh city and Quang Ninh province. UNIDO delivered a total of 25 hydrocarbon-based refrigeration units to cold storage facilities, to demonstrate the feasibility and benefits of the new technology.

UNIDO also delivered training on good servicing and maintenance practices, to reduce refrigerant leakages and increase energy efficiency, as well as dedicated training on the safe handling of hydrocarbon-based refrigerants.

These advances are helping Viet Nam transition away from HCFCs, thereby minimizing negative environmental impacts, whilst ensuring that the food industry operates efficiently, with minimal food loss. This brings us one step closer to achieving zero hunger.

These activities were carried out in the framework of the “Improving Energy Efficiency and Reducing ODS Emissions in the Cold Storage Sector” project, funded by the **GEF**.

The GEF is a trust fund designed to address global environmental challenges. In 2020, the GEF approved 44.9 million USD of funding for UNIDO projects around the world.

Video Kigali Amendment - Industry advocates for green solutions

Article R290 units in Vietnam’s cold stores delivering 20-25% efficiency gains



GOOD HEALTH & WELL-BEING

Ensure healthy lives and promote well-being for all at all ages.

Modern healthcare is a complex and extensive industry. It encompasses health care professionals, hospitals and health facilities, pharmaceuticals, diagnostic laboratories, and medical equipment and services. Manufacturing industries may not be at the face of healthcare campaigns, but without dedicated companies producing medical equipment and devices, we could not deliver essential health care services across the globe.

Medical devices must comply with the most severe regulatory standards and quality requirements. One of the highest priorities in the healthcare industry is the prevention of pathogens (a bacterium, virus, or other microorganism that can cause disease). This is a complex challenge given the nature of medical devices, which are made up of a series of moving parts with ridges and crevices in which bacteria and viruses can hide. The industry therefore relies on powerful solvents, many of which have a high **ODP**

[View SDG 3 Targets](#)



or high **GWP**, for cleaning equipment at every stage of the production process.

In Tunisia, the medical devices manufacturing sector is growing rapidly to meet global demand.

In 2019, Tunisia exported optical, technical and medical apparatus worth €634 million.⁶

In parallel, the country is becoming an ever more popular destination for health and wellness tourism, driving the demand for medical devices within Tunisia.

Now, Tunisia is working with UNIDO to introduce climate-friendly solvents and clean technologies in medical device manufacturing processes, to phase out greenhouse gases and help mitigate the impact of climate change on human health.



SO.F.A.P Medical is a Tunisian pharmaceutical company specialized in the manufacturing of medical devices, including syringes, needles, infusion and transfusion sets. SO.F.A.P was heavily reliant on ozone-depleting HCFC-141b for the manufacture of syringes, both as a solvent and a thinning agent for silicone oil. Syringes are coated with a layer of silicone oil, to reduce friction when the needle pierces a patient's skin - anyone who has ever had a vaccine, should be grateful for this technology. When applying the silicone, the tool used to coat the needle is also coated in oil and needs to be cleaned carefully and regularly, calling for a high demand and frequent use of HCFC-141b.

Facing the challenge of altering two key components of their production process, SO.F.A.P partnered with UNIDO and the National Agency for Environment in Tunisia (ANPE) to find a cost-effective and sustainable alternative to HCFC-141b. Following numerous product trials, laboratory testing and performance evaluations, UNIDO and SO.F.A.P successfully identified an alternative solvent, with no ODP. They were then faced with another problem:

the new solvent technology was 20 times more expensive than HCFC-141b.

The solution for this was simple and elegant. Recognizing the high consumption of HCFC-141b for the silicone oil application, UNIDO, ANPE, SO.F.A.P and a group of private sector technology providers, designed an automatic silicon spray machine, to circumvent the use of HCFC-141b altogether.

UNIDO supported SO.F.A.P with the redesign of the production line, training and equipment installation, which resulted in an 80% reduction in the amount of solvent required.

Following the completion of this project in 2019, SO.F.A.P launched a range of green products for the domestic and European market.

This partnership demonstrates the wide expanse of possibilities for delivering climate-friendly, energy-efficient and affordable solutions for the healthcare industry.



QUALITY EDUCATION

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Education is the key to unlocking the potential of each individual in our global community. Skilled employees raise the productivity of labour forces and make investment in industry more attractive. This contributes to sustained employment, higher wages and decent jobs. In the **RAC** sector, skills and expertise are also a matter of safety. Technicians need to understand what materials they are working with and master tools, technologies and techniques to keep themselves, other people, and the planet safe.

To successfully phase-out **ODS** and **F-gases** from major manufacturing sectors, both end-users and technicians need to understand what alternatives are available, and which ones are best-suited. There are many sustainable alternatives, but each one comes with its own performance, compatibility and safety considerations. Technicians working in the RAC sector need both theoretical and practical knowledge, so that they can work with fluorinated and non-fluorinated gases and incorporate safe handling practices into their daily routine.

In Armenia, the Government is working to make training and certification for RAC sector technicians mandatory. The idea is for all technicians to receive

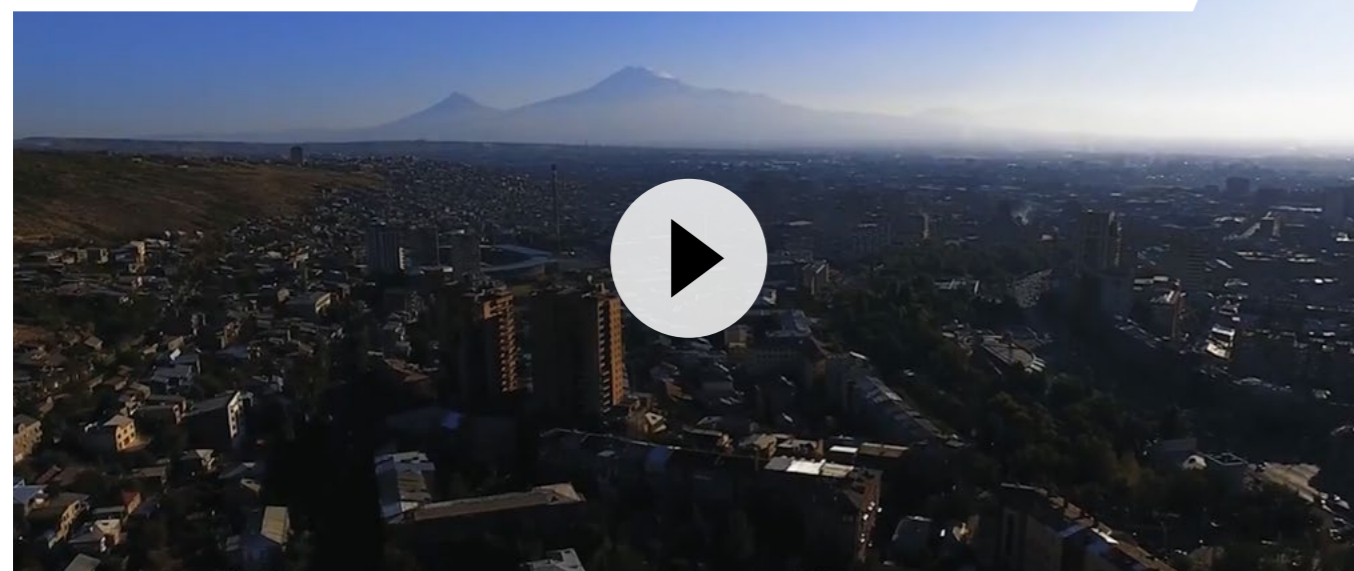
a minimum standard of training, in line with international standards on the safe handling of ODS, F-gases and natural refrigerants. But policy is only one piece of the puzzle. The Government realises that to reach all technicians at the national level, they need to work with industry associations, institutes of higher learning and vocational centres. With support from UNIDO and the Russian Federation, the Government successfully launched a centre of excellence for the training and certification of technicians – not just for Armenia, but also for neighbouring countries in the Eastern Europe and Central Asia region.

“The HVACR training centre is very well equipped with several RAC didactical units (including AC split, unit with F-gases, equipment with CO₂ and with hydrocarbons). The technological relevance of the equipment is high.”

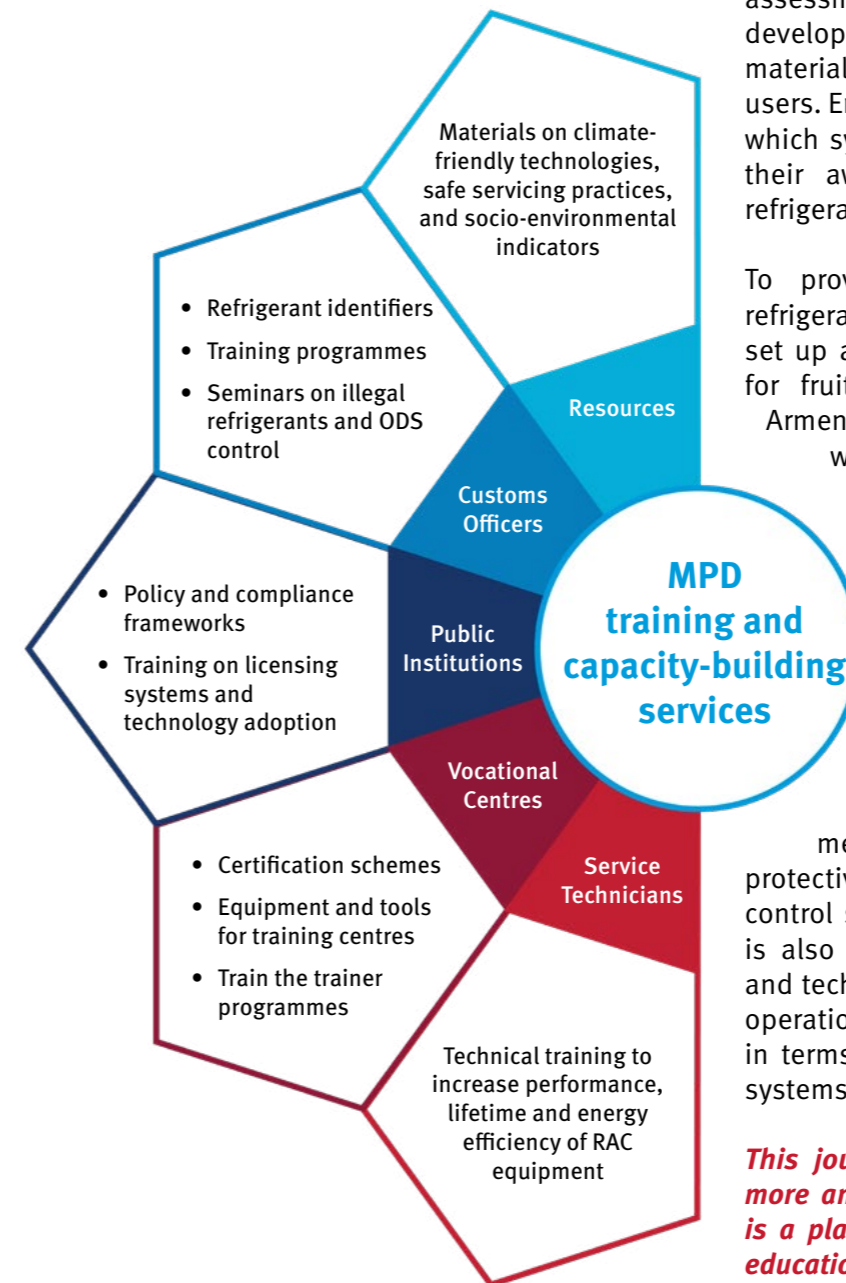
Centro Studi Galileo

[View SDG 4 Targets](#)

Promoting life-long learning in the refrigeration & air-conditioning sector, Armenia



The “Regional Centre for Continuing Education and Certification for **HVACR** Industry Professionals” in Armenia was born of an ambitious vocational centre and 5 specialised RAC technicians. Together with the Government of Armenia and UNIDO, these partners set out on a journey to scale-up technical training in the RAC sector and put natural refrigerants on the map.



The first step was to equip the Centre. UNIDO provided simulation equipment, tools and supplies for hands-on training on sustainable alternatives to F-gases, energy efficiency and good refrigeration practices. UNIDO then enrolled the 5 technicians in an intensive ‘train-the-trainer’ programme, where they learned how to develop their own teaching curriculum and set up practical and theoretical assessments for certification. The Centre then began developing training manuals and communication materials, directed both at technicians and end-users. End-users are ultimately the ones who decide which system to install, so it is critical to increase their awareness and understanding of natural refrigerants.

To provide a real-world example of natural refrigerants in industry, UNIDO and the Government set up a pilot project at a distribution warehouse for fruits and berries in the Kotayk Province, Armenia. UNIDO worked hand-in-hand with the warehouse to convert their very harmful CFC-12 refrigeration system to one run on R290 (propane). Propane’s advantage is its ultra-low **GWP** and zero **ODP**. On the other hand, propane is flammable, so strict safety measures have to be put in place.

The Centre now organises site visits to the warehouse for trainee technicians. Here, they can see how the safety measures – including an explosion-proof protective casing and a R290 sensor linked to the control system – work in practice. The warehouse is also a good demonstration site for end-users and technology providers. They can see the system operation parameters in real time, and the benefits in terms of resource use and energy efficiency of systems run on natural refrigerants.

This journey shows us that in the face of ever more ambitious climate targets, the RAC industry is a platform for innovation, continuing technical education and lifelong learning opportunities.

These activities were carried out in the framework of the “Development of international regional centre of excellence for training and certification and demonstration of low-global warming potential

alternative refrigerants for the Europe and Central Asia region” project, funded by the **MLF** and the Russian Federation.

Article Training and continuing education for HVAC technicians

Video Inauguration of the Regional Centre for HVACR Industry Professionals (Russian)



GENDER EQUALITY

Achieve gender equality and empower all women and girls.

Gender equality is a vision of a world in which women and men have equal standing, access to resources, rights and opportunities. A world in which there are no legal, social or economic barriers to women's empowerment.

Women represent half of the world's working-age population, but only 39% of the world's workers.⁷ In this sense, increasing the labour force participation of women is both a social and economic imperative. What's more, investing in women has broader socio-economic benefits.

On average, women reinvest 90% of their income into healthcare, education and social well-being,⁸ driving sustainable development on a global level.

In South Africa, equality, diversity and inclusion are at the forefront of the national dialogue and legislation. The South African Constitution guarantees equality before the law and freedom

from discrimination on the basis of race, gender, sex, pregnancy, marital status, ethnic or social origin, colour, sexual orientation, age, disability, religion, conscience, belief, culture, language and birth.

South Africa accomplished a major milestone on gender parity in 2019, by electing 14 women and 14 men as cabinet ministers.⁹ This makes South Africa one of only 14 countries in the world with a gender-balance or female majority in their cabinet. On the other hand, gender-based discrimination and violence, educational disparities and unequal gender roles still need to be addressed to achieve true gender equality.

Individuals, institutions and industries all have a role to play. In addition to cultural and social barriers, there are a number of firm-related factors that limit the participation of women in industry. These include business culture, hiring practices and working conditions. Fortunately, companies are beginning to change their policies and practices, so as to create viable working environments for women and promote gender equality in their workforce.

[View SDG 5 Targets](#)



Defy Appliances is South Africa's largest manufacturer of domestic appliances, including refrigerators and freezers. Defy's production process relied heavily on HCFC-141b for the production of polyurethane (PU) foam. PU foam is very versatile and can be found in construction materials, mattresses, packaging and even the soles of our shoes. It is also used as insulation in refrigerators and freezers, a

key component for keeping the temperature cold and the humidity low.

Under the **HPMP** for South Africa, Defy partnered with UNIDO and the Government of South Africa to completely phase-out HCFCs from their products and production models. This meant finding an alternative to HCFC-141b, with the same product performance, but without the environmental impact.

Defy opted to convert to cyclopentane, a foam blowing agent with no **ODP** and a **GWP** of less than 10 (compared to HCFC-141b's GWP of 725). With UNIDO's technical support, Defy replaced their entire PU foam production line; from the foaming machinery, to the storage tanks and mixing room. Defy became one of the first manufacturers in South Africa to successfully convert to HCFC-free production.

In parallel, Defy made some other admirable leadership decisions – and more importantly – concrete changes to improve the working environment for their female employees. Women play a key role in the **RAC** industry, including producing, installing and servicing equipment. The tools they use, however, are usually designed around male data. This translates into poor-fitting protective equipment, discomfort from non-optimal body positioning, and safety risks for female employees.

Defy embarked on a redesign of their production line at their East London plant, changing the “standard-issue” settings of their equipment, to meet the needs and anatomical differences of their employees. By 2019, the female employees at Defy outnumbered the men, contributing to every stage of the production process, from design to quality control.

Now, Defy is relocating the plant to another province of South Africa, taking along both the cyclopentane equipment adopted in the framework of the HPMP, and the lessons learned in East London on integrating gender equality in the work force.

This is a compelling example of the concrete changes that companies can make to promote workplace equality for women and men – an important marker on the path towards gender equality.



EQUALITY

UNIDO promotes equal participation, rights, responsibilities and opportunities for women and men.



INVESTMENT

UNIDO promotes women entrepreneurship, by providing technical training and leveraging finance.



ENGAGEMENT

UNIDO promotes equal engagement in decision-making processes at local, national and global levels.



ANALYSIS

UNIDO conducts gender analyses for industrial development projects and collects sex-disaggregated data.



POVERTY ALLEVIATION

UNIDO drives investment in inclusive and sustainable industrial development for poverty alleviation and shared prosperity.

These activities were carried out in the framework of the **HPMP** for South Africa, funded by the **MLF**.



CLEAN WATER & SANITATION

Ensure availability and sustainable management of water and sanitation for all.

Water is a fundamental human need. We need safe, clean water for hydration, sanitation and food production. Even the water that we use for agriculture has to come from safe sources. If we water our crops and grains with contaminated water, bacteria and disease can spread to those who consume the final products. Sadly, vast quantities of clean water – estimated at 250km³ per year - are used to produce food that is ultimately lost or wasted.¹⁰

Food loss reduction can therefore help us reduce the amount of clean water that it is wasted on an annual basis. For this, we need effective cold chains. The cold chain is a temperature-controlled supply chain that preserves and extends the shelf life of our food and other temperature-sensitive products (from vaccines to photographic film). For cold chains to be effective, we need to maintain an uninterrupted low temperature at every stage of the process. This includes cold storage, processing and distribution, refrigerated transport, and chilled display. With so many steps, there are plenty of opportunities for error, but also many possibilities for making each link in the cold chain more effective, reliable and sustainable.

In the Philippines, over 40% of food loss occurs during the production, postharvest, and processing stages.¹¹ Rice is one of the most important staple foods in the Philippines, with each citizen consuming around 118 kg of rice per year on average.¹² It is also the most water intensive crop, because the fields have to be flooded in order for the rice to grow. Regrettably, up to 15% of rice is lost in postharvest.¹³ For those of us who store our rice at room temperature, the link to the cold chain might not be immediately clear. But it is the temperature- and humidity- controlled environment in the processing phase that protects rice from pest infestations and fungus.

Effective cold chains could allow farmers to preserve every grain of rice harvested and every ounce of water that went into its production.

The Government of the Philippines is going to great lengths to reduce food loss and maximise water-use efficiency, by establishing reliable cold chains. Under the “Global Partnership for Improving the Food Cold Chain in the Philippines” project, UNIDO is helping the Government mobilise resources, funding and technical expertise to promote sustainable and innovative cold chains.

View SDG 6 Targets

Energy efficient cold chains can reduce energy demand. 75% of cooling emissions come from energy consumption.

(IOR, 2014)

Adequate refrigeration can prevent food contamination. 600 million people annually fall ill from contaminated food

(WHO, 2020)

Cold chains can help conserve water. We consume 250km³ of water each year to produce food that is then wasted.

(FAO, 2013)



Clean cold chains can reduce greenhouse gas emissions. Food sent to landfill produces methane which is 84x more potent than CO₂.

Effective cold chains could save 475 million tonnes of food annually and feed 950 million people.

(FAO, 2011)

Cold chains can help conserve land for agriculture. 28% of arable land is used annually to produce food that is lost.

(FAO, 2013)

The Cold Chain Innovation Hub (CCI-Hub) is the physical and virtual platform for action in this project. The CCI-Hub connects a network of national and international actors to improve the efficiency and environmental sustainability of cold chains.

The role of the Government in this partnership is to establish the legal framework. Policies and regulations are needed to incentivise the uptake of innovative technologies, and in particular, climate-friendly refrigerants. Refrigerants are a key component of the cold chain, but the traditional substances used for cooling either damage the ozone layer or contribute to global warming. Policies can be used to restrict the use of harmful refrigerants, but also to establish economic incentives for the use of sustainable alternatives. Once these policies are in place, the country has to mobilise funding to put economic incentives into practice.

This is where financial institutions and industry leaders come into play. For a company working in the cold chain industry to adopt a new refrigerant, they need to find the best-suited alternative to their production process and modify components so that they are compatible with the new refrigerant. This requires investment in R&D, development of prototypes and purchase of new equipment. To address the funding gap, UNIDO and the Government of the Philippines successfully mobilised 22 million USD, in the form of grants and credit lines. Now, industries can finance their transition with loans from the financial institutions engaged in this partnership.

In a world of ever changing technology, this partnership shows us how we can use technological innovation to solve our global problems and conserve water, one of our most valuable resources.

Cold Chains: feeding the world and protecting our planet



These activities are being implemented in the framework of the “Global Partnership for Improving the Food Cold Chain in the Philippines” project, funded by the GEF.

[Website](#) UNIDO Open Data Platform

[Newsletters](#) Cold Chain Innovation Hub Newsletter

[Website](#) Cold Chain Innovation Hub

[Report](#) Evaluating the Philippines’ Food Cold Chain

[YouTube](#) Cold Chain Innovation Hub

[Video](#) Webinar: Evaluating the Food Cold Chain



AFFORDABLE & CLEAN ENERGY

Ensure access to affordable, reliable, sustainable and modern energy for all.

Energy is what drives our economies, fuels our industries and propels human development. With the world economy projected to double in the next 20 years,¹⁴ energy efficiency is gaining traction on the global agenda.

Energy efficiency is also critical to limiting greenhouse gas emissions and meeting our climate targets. To drive energy efficiency improvements in industry, we need supportive regulatory frameworks, system-level integration and new technologies. Governments play a key role in incentivising change, but companies need to put these policies into action.

[View SDG 7 Targets](#)



The commercial food sector of Turkey includes a wide network of supermarkets and food and beverage shops. All of these industries were once reliant on HCFC-22 - a refrigerant with a high **ODP** and **GWP** - to store and display their products at low-temperatures.

In Turkey, electricity use in commercial buildings represents about one-third of the country's total energy consumption,¹⁵ with cooling systems accounting for the majority of this demand.

Recognising the pressure this places on the energy grid and the climate, the Government of Turkey partnered with the Association of Refrigeration Industry Businesspeople (Sogutma Sanayii Is Adamlari Dernegi Iktisadi Islemesi – SOSIAD) and UNIDO to promote energy efficient and climate-friendly cooling solutions in Turkey's commercial refrigeration sector.

In 2015, the Government of Turkey enforced a ban on the use of HCFC-22 for **RAC** systems sold on the local market. This meant that local manufacturers had to switch to alternative refrigerants and design new equipment for the commercial food sector. This project was spurred on by SOSIAD and UNIDO, who

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This project which also presents the economic advantages of sustainable cooling, and takes care of energy efficiency, has certainly succeeded in its goal of creating a national awareness.

”

Kivanç Aslantaş
Coordinator of the demonstration project

had higher ambitions than simply circumventing the Government's ban. They wanted to find the best-suited alternatives to HCFC-22, in terms of environmental sustainability, reduced operating costs and energy efficiency.

The pioneers in this field were Çağrı Market (Fikirtepe), Sariyer Market (Ferahevler) and Sariyer Market (Etiler) in Istanbul; Eti Soda Plant in Ankara; and Algida Ice-Cream Production Plant in Izmir. At each of these pilot sites, non-HCFC technologies were put to the test. SOSAID and UNIDO worked hand-in-hand with these companies and local technology providers to find suitable alternatives, ranging from natural refrigerants to **HFOs**.

The chosen refrigerants all have zero ODP and little or no GWP, but different properties and safety considerations. The pilot projects therefore included technical training to local technicians, to ensure that they could safely operate, service and maintain the

new equipment. The training also covered how to reduce refrigerant leaks, increase energy efficiency and improve performance.

For SOSIAD and the Government this was only the first step. They wanted to have tangible data to support their nationwide campaign on the benefits of low GWP refrigerants. This meant comparing the energy efficiency of the original systems with the new refrigeration systems, as well as measuring the life cycle climate performance (LCCP). The new equipment, run on low GWP refrigerants, proved to be more advantageous, by reducing both energy consumption and greenhouse gas emissions.

Finally, equipped with real-world examples from Turkey, SOSAID and UNIDO set out to raise awareness on the technical feasibility and potential advantages of low GWP refrigerants. They held thematic workshops in Ankara, Istanbul and Izmir and field visits to the demonstration sites. For industries faced with the challenge of replacing equipment run on HCFC-22, this served as a valuable source of information on available technologies, potential solutions and future trends. What's more, the end-users and technology providers could see these technologies operating in real-time, a key step for replicating these initiatives and bringing these technologies to scale.

At every stage of this project, the partners placed equal emphasis on environmental sustainability, human safety and energy efficiency, recognising that each one is key to achieving sustainable development.

These activities were carried out in the framework of the “Demonstration and Pilot Activities for Encouraging Low-global warming potential (GWP)

Refrigerants in Republic of Turkey” project, in the framework of the **HPMP** for Turkey, funded by the **MLF**.

Website → [Demonstration Project for Turkey](#)

Magazine → [Termoklima Issue 134](#)

Brochure → [Demonstration Project for Turkey](#)

Magazine → [Termoklima Issue 328](#)

Press Release → [Demonstration Project for Turkey](#)

Magazine → [Termoklima Issue 327](#)

Magazine → [Tesisat Issue 288](#)

Magazine → [Termoklima Issue 325](#)



DECENT WORK & ECONOMIC GROWTH

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Employment is a valuable marker for measuring human development. In the classic example of economic growth, labour shifts from agriculture and other labour-intensive occupations, to industry and then finally to the services sector.

Increasing manufacturing output and improving the quantity and quality of jobs in the industrial sector is therefore at the top of the agenda in many developing countries.

Nations with small manufacturing sectors are forced to import the majority of their finished products from other countries. This means that consumers have to absorb the costs of customs duties and taxes on shipments. It also means that the money spent on these goods flows out of the country, driving employment and development elsewhere.

In Uganda, industry first began to flourish in the mid-1940s, with injections of foreign capital and increased government expenditure on ‘productive’ public investments.¹⁶ However, once the Economic Commission for Africa was established in 1958, funding was channelled towards the industrialization of eastern Africa as a whole. This strategy was based on the premise that the markets in each individual country were too small for large-scale industrialisation.

As a result, Uganda’s industrial sector did not grow as planned and the country is still heavily dependent on imported materials, such as heavy machinery. On the other hand, local industries and entrepreneurs have begun to see the value in manufacturing products locally. More and more businesses are choosing to shift from importation to production, fuelling the local economy and creating new employment opportunities.

[View SDG 8 Targets](#)



“

As soon as we received this set of equipment from UNIDO, everything changed for the better. We stopped receiving complaints from our customers and most importantly all our products are leak proof and have the right quantity of refrigerants which was not the case in the past.

”

Peter Samula
Director of GETS

Gayaza Electronic Works Ltd (GETS) was Uganda’s very first manufacturer of domestic refrigerators. The visionary behind this venture, Peter Samula, started his career in the refrigeration industry in the year 2000 by importing used refrigerators and selling them on the local market. This was a lucrative business until the Government of Uganda, as a signatory to the Montreal Protocol, imposed a ban on the import of used electrical appliances in 2002.

Samula first hoped to keep his business running by importing new refrigerators into the country, but found that the prices were prohibitively high for the majority of his clients. Faced with this setback, the entrepreneur vowed to start his own refrigerator manufacturing company. His vision: to produce low cost refrigerators for low-income earners.

The very first model Samula produced did not come out as planned. Samula recalls that “the cooling system was not well functional and the product quality was poor.” But with perseverance – and a credit loan – Samula was able to hire a team and set up a larger production facility. Nonetheless, the

company still faced major challenges in relation to quality control, with many of their products prone to leakages and poor performance.

In 2017, UNIDO helped GETS transform their manufacturing process, to maximise efficiency, reduce costs and improve quality control; all of which helped GETS increase the value of their products. UNIDO delivered all of the necessary equipment, including vacuum pumps and tools for cleaning internal parts, monitoring moisture levels and leak detection, and measuring the quantity of refrigerant. Following this intervention, the company saw a major change in their products and a positive response from their customers. Then, in 2018, UNIDO – with additional funding from **K-CEP** – helped GETS integrate energy efficiency improvements in their products; contributing both to the company’s economic and environmental sustainability.

This led to an increase in production, energy efficiency and sales for GETS, generating 25% more employment in the following years. Now, GETS ranks among the most prominent employers in the refrigeration industry of Uganda.

“

With the support of UNIDO, we have trained over 300 refrigeration practitioners in Uganda. Refrigeration is a very unique profession. It encompasses scientific knowledge and technical skills, giving practitioners the skills to attract employment.

”

Paulo Odu
Project Coordinator

These activities were carried out in the framework of the **HPMP** for Uganda, funded by the **MLF**, and the “Support to refrigerator manufacturers to improve Energy Efficiency during the F-gas transition” project funded by **K-CEP**.

K-CEP is a philanthropic collaboration to support the implementation of the **Kigali Amendment**. To date, the 17 participating donor governments, non-profit organizations and individual investors have pledged 51 million USD to drive the transition to energy efficient, clean cooling solutions for all.



INDUSTRY, INNOVATION & INFRASTRUCTURE

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Industry is a driving force for sustainable development. As industry grows, it boosts economic growth, job creation and investments in technology, innovation, skills and education. The big challenge is to ensure that the benefits of industrialization reach everyone, everywhere.

To achieve inclusive and sustainable industrialization, we need to integrate environmental sustainability and social inclusion in our business models and production processes. Then, we need to bring these to scale. For this, we need the commitment and collaboration of industry leaders.

China is the global leader in the production of air-conditioning appliances, producing around 70% of the world's room air conditioners.¹⁷ China also has one of the world's fastest growing domestic markets for air-conditioners, owing to the country's rising economic power, urbanization, growing middle class and changing climate. From 2000 to 2020,

the energy demand for space cooling in Chinese buildings increased by 13% each year – the fastest recorded growth in world history. This represents two challenges: a strain on the country's electricity system and a threat to the environment from greenhouse gas emissions and climate change.

Conventional air-conditioners produced in China run on HCFC-based refrigerants, which deplete the Earth's ozone layer, or HFC-based refrigerants, which contribute to climate change. This means that every air-conditioner sold, comes at a cost to the environment.

In the face of this challenge, the Government of China partnered with UNIDO and leading air-conditioner manufacturers in the country to find sustainable cooling solutions. They embarked on a 10-year journey to bring these products to market and to scale. Together, they demonstrated that green product innovation is not only key to improving the environmental footprint of industry, but also to enhancing products, energy efficiency and economic performance.

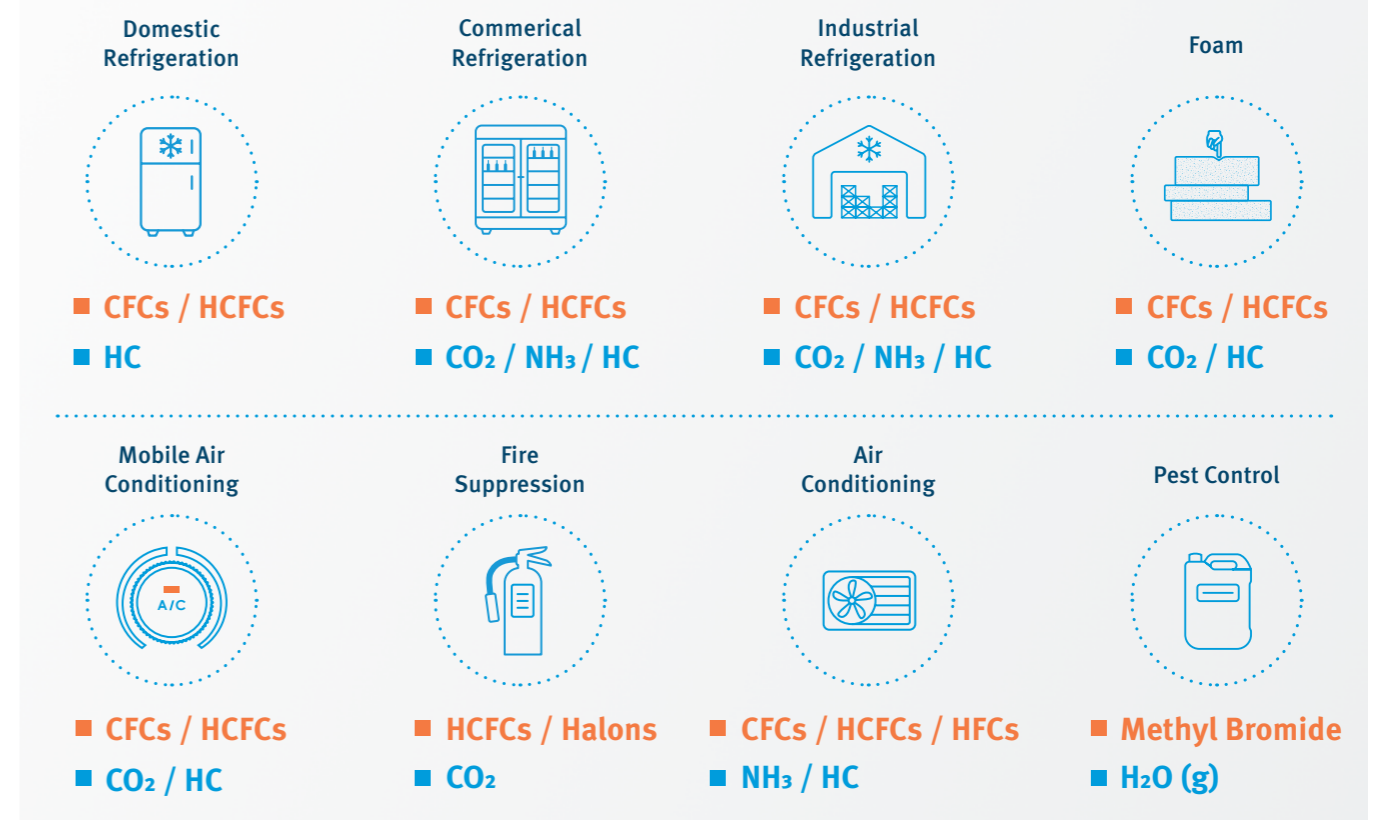
[View SDG 9 Targets](#)

UNIDO awards Midea for its outstanding contribution to environmental protection



联合国工业发展组织与美的一起 不断探索家用空调在环境保护与可持续发展的方案
UNIDO has worked together with Midea to search for environmentally sustainable solutions for residential air conditioning

UNIDO is currently working with 83 countries around the world to phase-out HCFCs and phase-down HFCs from key industrial sectors. For every industry and (almost) every application, there is a suitable and sustainable alternative.



■ Traditional Ozone Depleting Substances
■ Sustainable Alternative Substances

Midea, China's largest exporter of air-conditioners,¹⁸ was the first manufacturer to partner with UNIDO and transition to natural refrigerants. This process is not as simple as it sounds. Different refrigerants affect the capacity and efficiency of air-conditioners, so these have to be redesigned to match (or outshine) the performance and operating costs of previous models. The manufacturing lines used to produce them also have to be redesigned for specific characteristics of the refrigerant, especially flammability. And the technicians that service these air-conditioners have to be trained on how to safely install and maintain the new systems.

Midea opted to transition from HCFC-22, a powerful greenhouse gas, to R-290 (or propane), a natural refrigerant with negligible GWP. UNIDO supported Midea in re-designing their products and production lines and training their technicians.

The next step in the process was to market these products and bring them to scale – the biggest challenge yet. The Government of China has played an important role in this, by establishing incentive schemes and promoting the adoption of sustainable cooling in public institutions. A promising example of this was the installation of 1000 propane-based air conditioning units at a student dormitory in Jiaxing.

The Government of China, UNIDO and major manufacturers, including Midea, are working to increase the uptake of propane-based air-conditioners, both at the national and global level, to truly achieve economies of scale. There is still work to be done, but the journey thus far is proof that industry leaders have a key role to play in pioneering technologies for a sustainable future.

These activities are being carried out in the framework of the [HPMP](#) for China, funded by the [MLF](#).

[Press Release](#) Midea Awarded by UNIDO for Environmental Protection Efforts

[Award](#) Midea receives Certificate of Outstanding Contribution



REDUCED INEQUALITIES

Reduce inequality within and among countries.

Industry is one of the building blocks of sustainable development. But to truly achieve inclusive and sustainable growth, industrialization must include all countries and all persons; irrespective of age, gender, race, religion or disability.

On a global level, we are making good progress on mainstreaming disability inclusion into policies and legislation, but we have a long way to go to achieve the full participation of disabled persons in social life and development. The productive sector, in particular, has a low penetration of employees with disabilities. But now, with the global shift towards employee diversity and new production models under industry 4.0, there is hope for change.

In Belarus, the Government is taking concrete steps to integrate policies on disability and inclusion into national legislation. In 2018, the Government drafted a law “On the rights of persons with disabilities and their social integration”. Legislation, however, is not the only means of social change. Governments can influence business behaviour through policies and economic incentives, but it is up to companies to take concrete action.

Fortunately, industry leaders are beginning to recognise the value of a diverse labour force and are working to remove the cultural and social barriers deterring the full participation of persons with disabilities.

View SDG 10 Targets

JSC “BelVTI” is a leading waste management company in Belarus, and an important partner in UNIDO’s regional project for Armenia, Belarus, Kazakhstan and Ukraine. UNIDO is working with the public and private sector in each of these countries to develop the necessary legislation, infrastructure and capacity to destroy ODS and POPs, in a safe and sustainable manner.

BelVTI is engaged in the first part of the process: the collection of waste materials. In the case of ODS disposal, this means collecting obsolete or non-repairable refrigerators, freezers and air-conditioners and extracting any remaining ODS (from the insulation foam or cooling circuit). When appliances come into BelVTI – from companies or collection points – the employees first assess



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In JSC BelVTI, there is no prejudice or division of employees into full-fledged and disabled, everyone works for a common result.

”

Alexander Kirpichnik
Director of BelVTI

the technical condition and maintainability. If the appliance is unrepairable, BelVTI extracts and recovers all valuable materials, such as iron, copper, aluminium and plastics and processes the waste. BelVTI’s role in UNIDO’s regional project is to capture and consolidate the ODS from this equipment, for subsequent disposal.

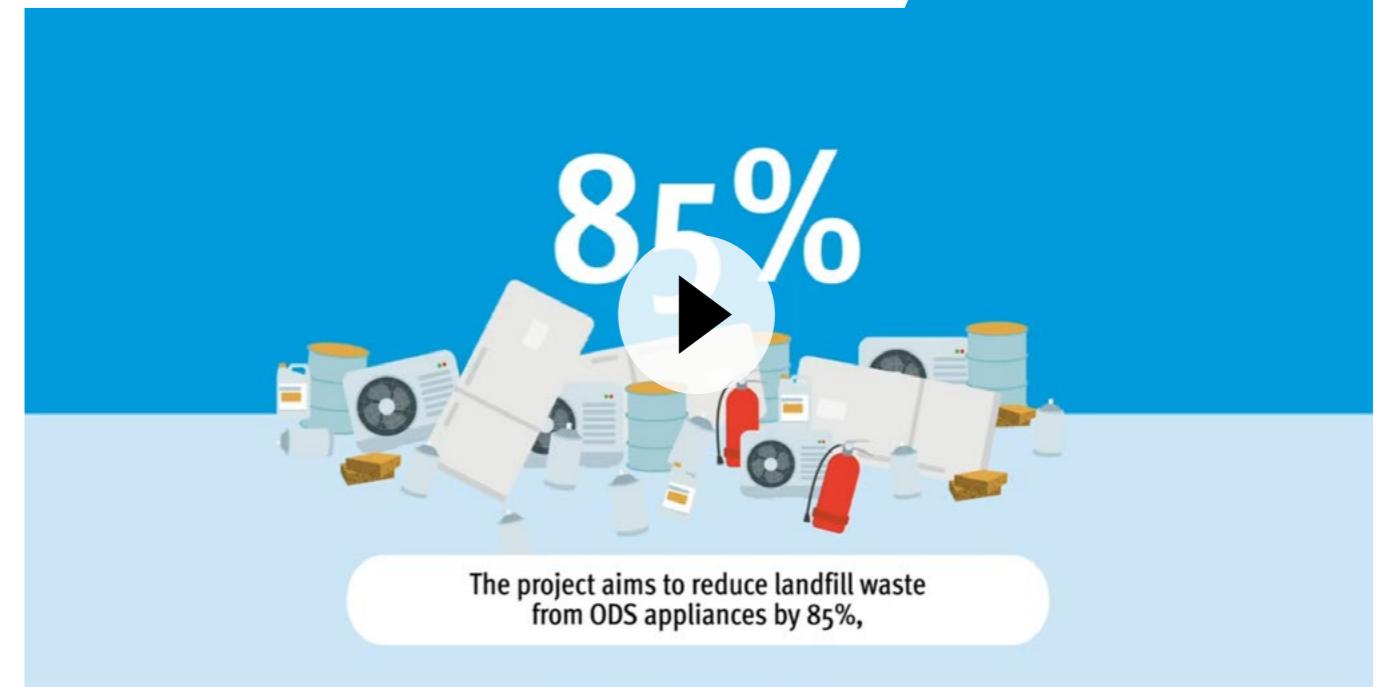
In 2017, BelVTI introduced a new business model for restoring and remanufacturing RAC appliances, recognising that much of the equipment supplied for recycling and disposal could be refurbished and given a second life. For this, the company employs

12 people with disabilities, pulling them out of long-term unemployment, training them and empowering them to participate fully and equally in society.

Prospective employees receive 3 months of training so that they can work independently as qualified experts. One of BelVTI’s employees, Aniky Sergey, has a medical diagnosis of cerebral palsy, but this does not prevent him from working as a mechanic. In his first 3 months at BelVTI, he worked as a repairman’s assistant, whilst undergoing technical training and acquiring practical skills. Now, he is an independent specialist and carries out repairs of any complexity on all types of household appliances.

In 2020, BelVTI successfully refurbished and sold over 4,000 units of refrigerators and large-scale appliances; illustrating the economic benefits of building sustainable and inclusive business models. In the global campaign to reduce inequality and discrimination, industry is proving to be a powerful vehicle of change, progress and development in society.

ODS Disposal: reducing waste and protecting the ozone layer



These activities are being implemented in the framework of the “Regional Demonstration Project for Coordinated Management of ODS and POPs

Disposal in the Ukraine, Belarus, Kazakhstan and Armenia” project, funded by the GEF.



SUSTAINABLE CITIES & COMMUNITIES

Make cities and human settlements inclusive, safe, resilient and sustainable.

Rapid urbanization is driving the demand for infrastructure and services in cities. At the same time, densely populated urban areas are seeing a rise in average temperature. Buildings, roads, and other structures absorb more of the sun's heat than trees and vegetation. They then re-emit this heat into their surrounding area, along with waste heat from industrial facilities, vehicles and air-conditioners. This is known as the heat island effect.

In Africa, the share of the population living in urban areas has steadily increased from 14.3% in 1950 to 43.5% in 2020, and is projected to reach 48.4% in 2030.¹⁹ This has put added pressure on governments to invest in key sectors such as housing, infrastructure, commerce and hospitality. It has also driven the demand for commercial air-conditioning to cool buildings and ensure the health, well-being and productivity of citizens.

In the Gambia, the share of urban population is higher than the continental average, with 58.2% of the population residing in urban areas. With average

View SDG 11 Targets

The Gambian air-conditioning market bloomed quickly. But it grew on the basis of weak foundations: inadequate servicing, poor maintenance practices and the use of outdated equipment. Air-conditioners are energy intensive appliances and, when serviced poorly, they also consume high levels of refrigerant. If a unit is not charged correctly – with either the wrong refrigerant or the wrong quantity – it will be less efficient. This is what service technicians and end-users in the Gambia were faced with. With increased energy consumption and annual losses of 200 - 300 kg of refrigerant per site, these practices came both at an economic and environmental cost.

Then in 2016, new air-conditioning appliances entered the Gambian market. These were marketed as reducing 70% of energy consumption, but were designed for R-410A or R-407C. Both R-410A and R-407C contain a blend of HFC-based refrigerants, with high GWP. This was clearly not a sustainable solution.

temperatures ranging from 18°C to 33°C, thermal comfort is a major urbanization challenge. During extreme heat events, the increased demand for air-conditioning can overload the electricity grid. The Government is then forced to temporarily cut power in selected areas, to avoid power outages.

The primary criteria for commercial air-conditioners in the Gambia was, therefore, energy efficiency and low cost; with little regard for refrigerants.

The majority of air-conditioning units are charged with HCFCs or a blend of HFC-based refrigerants with high GWP or a blend of refrigerants, including greenhouse gases. As a result, the benefits of air-conditioning have come at a huge cost to the environment.

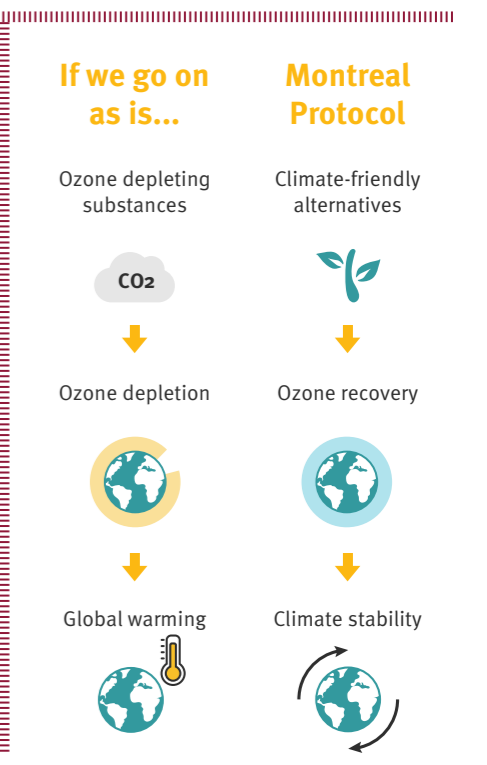
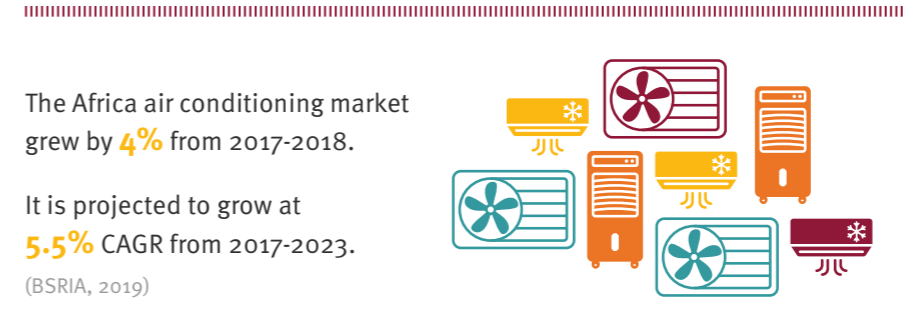
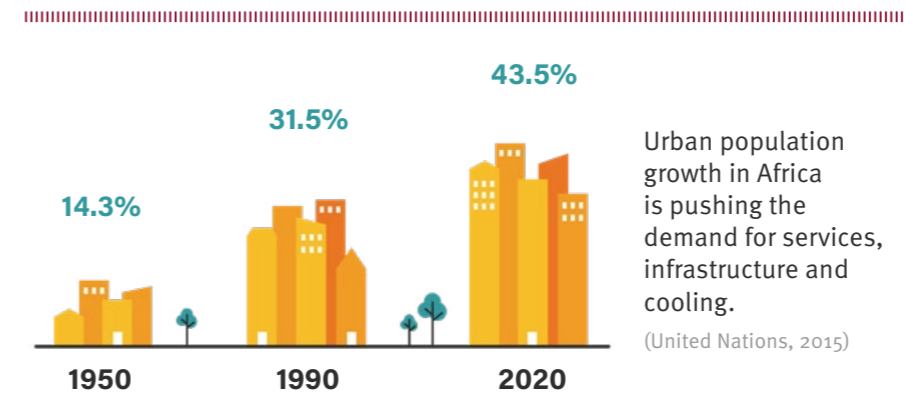
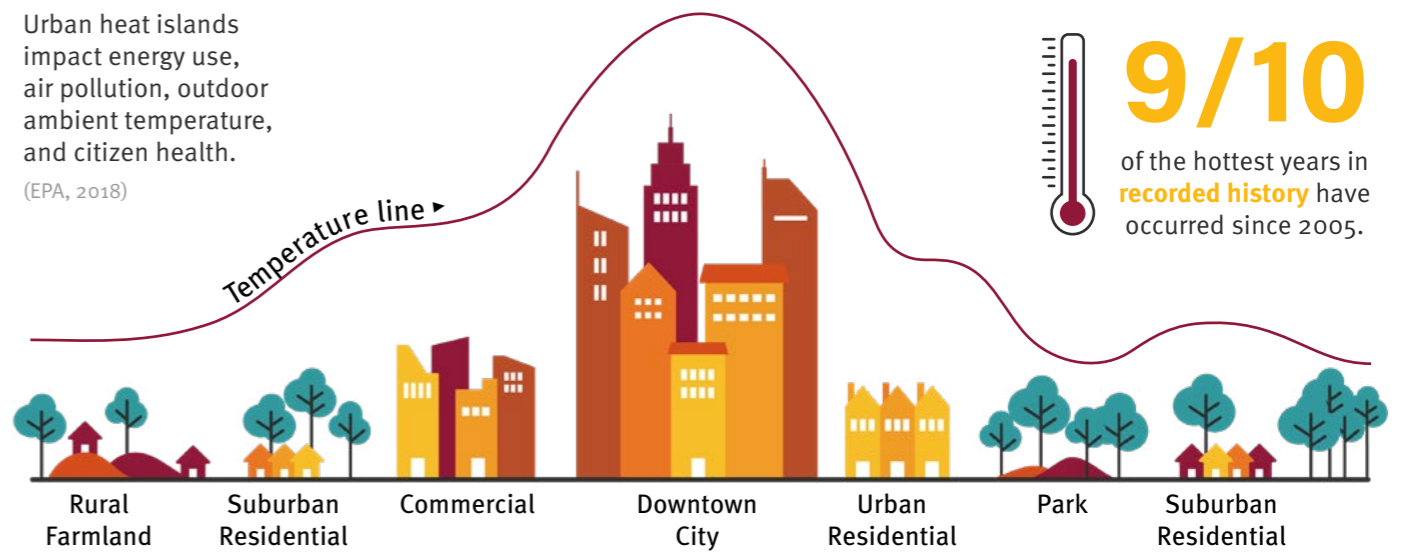
To address this problem, the Government of the Gambia and UNIDO are working to promote sustainable cooling solutions and create healthier urban environments for people and the planet.

Faced with this concern, the Gambian National Environment Agency (NEA), the Gambian Technical Training Institute (GTTI) and the Gambia Refrigeration and Air Conditioning Service Support (GRACSS) partnered with UNIDO to find another solution. The answer: natural refrigerants. These alternatives include ammonia (R-717), carbon dioxide (R-744) and hydrocarbons; the most common of which is propane (R-290).

To demonstrate the benefits of air-conditioning equipment run on natural refrigerants, UNIDO installed 200 propane-based room air-conditioning units in hospitals, universities, health centres and other public institutions. But this was only one piece of the puzzle. Service technicians, responsible for the maintenance of this equipment, had to be trained on the use, risks and safe handling of propane and other natural refrigerants.

Together with GTTI, GRACSS and NEA, UNIDO delivered training to 130 service technicians, now known across the country as “super technicians”. These specialists are now equipped to safely charge, recover and recharge natural refrigerants, reduce leakage from old equipment, and increase

energy efficiency. This, coupled with new policies conducive to the adoption of alternative refrigerants, are the foundation for a sustainable air-conditioning sector in the Gambia; poised to meet the needs of modern, urban life.



These activities were carried out in the framework of the “Reducing greenhouse gases and ODS emissions through technology transfer in the

industrial refrigeration and air conditioning sector” project, funded by the GEF.



RESPONSIBLE CONSUMPTION & PRODUCTION

Ensure sustainable consumption and production patterns.

Consumption and production are the engine of the global economy. Over the past 50 years, we have seen a transformational shift in production and consumption models, driven by global efforts to reduce environmental impacts and end climate change.

The most abundant evidence for this is in our supermarkets. In every aisle of our grocery stores, we can find products with ecolabels and green certifications. But there is also a transformational change going on behind the display shelves - in our supermarkets' cooling systems.

Supermarkets are responsible for relatively high emissions of greenhouse gases from the refrigerants used in their air-conditioning systems, cold storage units and chilled display cabinets. These cooling systems are critical to extending the lifetime of food products and maintaining a safe and clean environment, as bacteria and other pathogens favour heat and humidity. The challenge is to find alternative refrigerants that meet the needs of

supermarkets, without harming the environment.

In Jordan, finding sustainable alternatives for cooling can be challenging due to the country's climate.

Under the Montreal Protocol, Jordan is recognised as a country with a high ambient temperature (HAT). This means that the peak monthly average temperature in Jordan has gone above 35°C for two months out of every year, over 10 consecutive years.

These temperatures have an impact on the performance of cooling equipment, so careful consideration has to be made when selecting the right refrigerant.

In the face of this challenge, the Government is working with UNIDO and industry leaders in the RAC sector to find effective, reliable and sustainable solutions for supermarkets.

[View SDG 12 Targets](#)

Promoting responsible and sustainable cooling in the commercial food industry, Jordan

Nasser Abdin
Abdin Industrial, cabinet manufacturer and installer, Jordan

We managed to prove that in Jordan the CO₂ system

“
We welcome this great opportunity for Jordan to showcase our pioneering spirit and deep commitment to advancing environmentally friendly solutions in all areas.
 ”

Nayef Al Fayez
Minister of Environment of Jordan

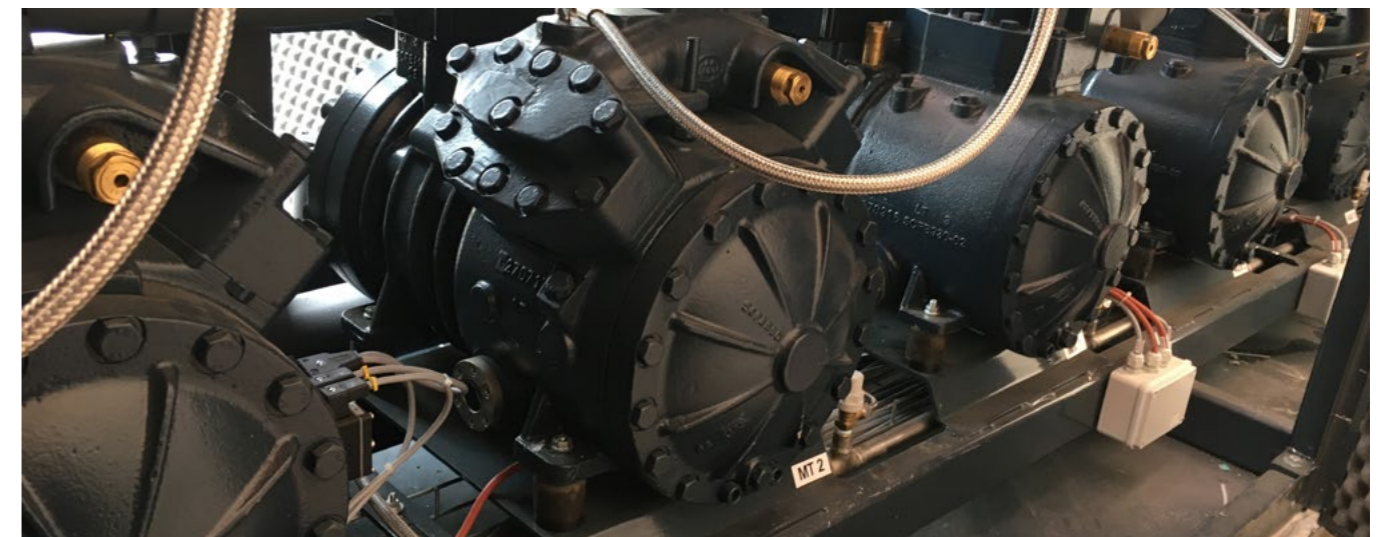
Al-Salam military supermarket in Amman became a pioneer in 2018 as the first store in the middle-east to run on a transcritical CO₂ refrigeration system. Al-Salam took on this challenge, with the help of UNIDO, the Government of Jordan and funding from **CCAC**.

In the global transition towards climate-friendly refrigerants, CO₂ had already emerged as a strong contender because of its negligible **GWP** when used in closed cycles. CO₂ also has no **ODP**. On the other hand, CO₂ technologies had not yet been proven to

operate effectively in HAT countries.

Al-Salam could have taken the easier route and installed a cascade system, which relies on both CO₂ and HFC-based refrigerants. Instead, they opted for transcritical CO₂ that runs solely on CO₂. Adoption of this technology requires a complete replacement of equipment, as stores with HCFC-based cooling systems can only reuse few, if any, existing components. Together, UNIDO, Al-Salam, Italian CO₂ pioneer Enex and Abdin Industrial, a local manufacturing company, redesigned the entire store; replacing everything from the piping to the display cabinets. This initial investment should not dissuade other supermarkets from making this transition, as it pays off in the end. In addition to CO₂'s environmental benefits, the cost of the refrigerant, maintenance and energy is much lower, resulting in lower operating costs overall.

Together, the project partners succeeded in bringing transcritical CO₂ technology to market, providing a real-world example of its application at elevated temperatures. With this, the partners have changed the landscape of commercial refrigeration in Jordan and HAT countries as a whole.



These activities were carried out in the framework of the “Demonstration of a CO₂ commercial refrigeration system in Jordan” project, funded by the **CCAC**. The CCAC promotes cost-effective technologies and practices to reduce pollutants

with a short lifetime in the atmosphere, including black carbon, methane and HFCs. This translates into immediate action to reduce global warming and mitigate climate change.

Article Global shift towards cost-effective, eco-friendly cooling technologies

Article Climate-friendly supermarket refrigeration installed in Jordan

Brochure Sustainable Food Cold Chain

Press Release Middle East's first CO₂ transcritical store delivers 30% energy savings in Jordan



CLIMATE ACTION

Take urgent action to combat climate change and its impacts.

Climate change is the single biggest threat to sustainable development and humanity as a whole. It is also a growing force in global politics, with 189 countries working to meet the ambitious targets of the Paris Agreement: a legally binding international treaty on climate change. One of the key targets of the Paris Agreement is to limit global warming to well below 2°C, if possible 1.5°C, compared to pre-industrial levels.

The global average temperature is now at 1.1°C above pre-industrial levels.²⁰ This means that all of us – individuals, institutions and industries – need to take urgent action to combat climate change.

Recognising the role of industry in this battle, the Parties to the Montreal Protocol adopted the Kigali Amendment, thereby committing to phase-out HFCs from major manufacturing sectors around the world. HFCs have a negligible impact on ozone depletion, but like many CFCs and HCFCs, have a very high GWP. This means that they trap heat in the lower atmosphere of the Earth, contributing directly to global warming.

Brazil ratified the Paris Agreement in 2016 and set itself the target of cutting GHG emissions by 37% by 2025, as compared to 2005 levels. Additionally, the Government of Brazil is working with UNIDO to phase-out ODS from key manufacturing sectors and adopt technologies with zero ODP and low GWP. Together, they are redefining industry’s relationship with the environment and promoting climate-resilient development.

View SDG 13 Targets

Eletrofrío is a leading manufacturer of commercial refrigeration equipment in Brazil. The company has also proven to be a leader in adopting innovative solutions to environmental challenges. Eletrofrío first partnered with UNIDO in 1999, to convert their production process from CFC-12 refrigerant (now banned globally) to HCFC-22 and HFC-404A refrigerants. This was back when the global community was determined to phase out CFCs and had not yet grasped the climate implications of HCFCs and HFCs.

Fast forward 20 years, and now we have the Paris Agreement and the Kigali Amendment: catalysts for the reduction of HCFCs and HFCs. Eletrofrío, once again, partnered with UNIDO to find an alternative refrigerant, convert their production process and re-design their products. Eletrofrío was determined to find a long-term solution for their cooling systems that would not be impacted by potential legislation in the future. They decided on propane, a natural refrigerant, with the advantage of it having no ODP and very low GWP.

With the technical support of UNIDO, Eletrofrío developed new modular propane-based chillers for

“ At Eletrofrío we are proud to have found a local solution to a global climate challenge. Our new chillers are run on 100% natural refrigerants and are 100% Brazilian. ”

Rogério Marson Rodrigues
Engineering Manager at Eletrofrío

supermarkets. This included developing and testing of prototypes, redesigning the manufacturing line and training technical staff on the safe operation of the new equipment. Because of propane’s flammability, great care is required in the design, manufacture, installation and servicing of chillers that contain this refrigerant. This is where the modular concept comes into play: the components can be safely assembled, installed and serviced individually. The added benefit for supermarkets is that servicing can take place without interrupting



cooling and that additional units can be connected to the system, opening up possibilities for future growth.

On this day, Supermercados Condor became the first supermarket in the country powered by 100% natural refrigerants.

Eletrofrío’s propane-based technology has successfully moved out of the lab and into the real world, with a measured energy efficiency improvement of 3% as compared to conventional systems. In 2019, Supermercados Condor, one of the largest supermarket chains in Brazil, opened a store equipped solely with Eletrofrío’s chillers.

Eletrofrío’s journey has shown that there is a market demand for environmentally sustainable products. The company says that the benefits of natural refrigerants go beyond environmental impacts, given the higher energy efficiency and lower resource demand. Industry leaders can rest assured that they can still meet their economic goals, while contributing to global action on climate change.

Propane chiller technology in use in Brazilian supermarket



These activities were carried out in the framework of the HPMP for Brazil, funded by the MLF.

Article Brazilian Supermarket Chain Sees Energy Savings with Remote R290 System



LIFE BELOW WATER

Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Conserving the world's oceans, seas and marine life is of vital importance, for both people and the planet. Ocean resources are critical for economic development and food security, particularly in coastal areas and in the marine food chain.

Oceans also play a key role in protecting the planet from climate change, by absorbing 23% of annual emissions of anthropogenic carbon dioxide.²¹ That is, the CO₂ emissions associated with human activities. While this helps mitigate extreme climate events, it comes at a cost to marine life. CO₂ saturation changes the pH level of ocean waters, gradually making them more acidic. When this happens, marine organisms such as oysters, coral and plankton struggle to build and maintain their shells and are at risk of these dissolving altogether.²² This is particularly problematic, as these organisms depend on their shells to protect them from ultraviolet (UV) radiation.

Ozone layer depletion, due in large part to **ODS**, increases the amount of UVB that reaches the Earth's surface and is absorbed by our oceans. UVB radiation impairs early development of fish, plankton and other organisms that form the base of the marine food chain.²³ This, in turn, has serious

implications on the livelihood and food security of coastal communities.

Mexico has one of the world's longest coastlines, extending 11,500 km.²⁴ The fishing and aquaculture sectors are major contributors to the country's economy; generating exports worth 1.28 billion USD in 2017 alone.²⁵ The health of this sector is not only vital for the economy, but also for the hundreds of thousands of small-scale fishermen and women living in coastal communities.

The Government of Mexico, as a Party to the Montreal Protocol, has taken great lengths to phase-out ODS from key manufacturing sectors and help restore the Earth's ozone layer.

But stockpiles of **RAC** equipment containing ODS have ended up in landfills across the country, where they continue to leak out into the atmosphere. These banks are not controlled by the Montreal Protocol. Nonetheless, the Government of Mexico, going beyond the ambitions of this treaty, set out to eliminate ODS banks. This is a key step to mitigating further damage to the Earth's climate, marine life and coastal communities.

[View SDG 14 Targets](#)

Montreal Protocol and ODS Destruction Project in Mexico



The Montreal Protocol is an universal agreement,

The Government of Mexico embarked on its mission to destroy ODS banks in 2011. Over the next 6 years, the Government, with the technical assistance of UNIDO and funding from France, successfully destroyed 113 tonnes of unwanted ODS banks. This equates to the prevention of over 504,000 tCO_{2e} or, in simpler terms, the emissions of 108,000 passenger vehicles over one year.²⁶

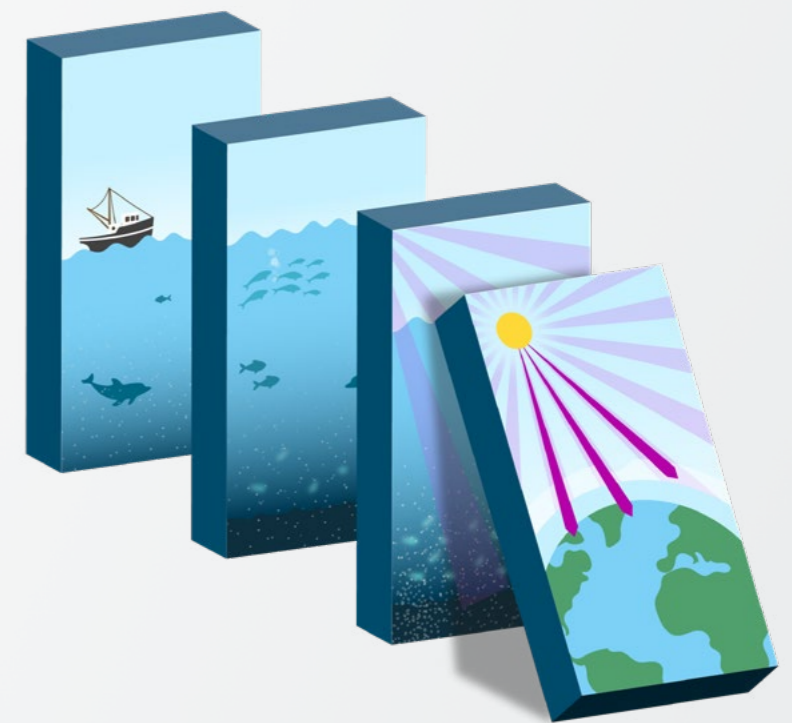
These achievements did not come easy. The Government had originally intended to export the ODS to the USA for disposal, as there were no authorized destruction facilities in Mexico. But the handling and exportation costs were so high, that the Government had to come up with a new plan. The solution: to establish local facilities for ODS disposal. The pioneers in this field were

Quimobásicos, a leading chemical company, and Holcim Mexico, a cement production plant. Building on their unique industry knowledge, the facilities each piloted a different technology from the list of approved disposal methods of the Montreal Protocol's **TEAP**. They, in turn, were equipped with cutting edge technology, all of the necessary licenses and training for their personnel to dispose of ODS in a safe and sustainable manner. The success of this initiative at both facilities proved the feasibility of two different technologies for ODS disposal: argon plasma arc and cement kiln co-processing.

Though ODS banks remain a challenge for many developing countries, Mexico has proven that we can find local solutions to some of the world's global environmental problems.

Effects of Ozone Depletion on Marine Life

- 1 Ozone depletion increases UV radiation.
- 2 UV harms plankton and other small organisms at the base of the ocean food chain.
- 3 The poor growth of plankton impacts the entire ocean food chain.
- 4 Fishing industries and coastal communities face dwindling fish supplies and food scarcity.



These activities were carried out in the framework of the "Demonstration Project for Disposal of Unwanted ODS in Mexico", funded by the **MLF**.



LIFE ON LAND

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Conserving terrestrial ecosystems and biodiversity is critical for human development. These ecosystems provide us with the majority of our food, in addition to energy, building materials, medicines, fresh water and clean air. Healthy terrestrial ecosystems also absorb carbon dioxide from the atmosphere and stabilise it in their soil. This reduces the effects of natural hazards like floods, landslides and droughts - a service that is becoming ever more important in the face of climate change.²⁷

Terrestrial ecosystems also sustain crop and livestock production. But to meet the needs of growing populations, we have pushed land productivity to its limits and introduced potent chemicals, used as pesticides, into our terrestrial ecosystems. Protecting our crops from pests and fungi is critical to protecting the livelihoods of farmers and reducing food loss, but in the past, it always came at a cost to the environment.

[View SDG 15 Targets](#)

Methyl bromide is a highly toxic chemical, traditionally used as a pesticide in soil and as a fumigant for treating agricultural imports and exports. Because of its high **ODP** and **GWP**, methyl bromide was banned under the Montreal Protocol*. This was a fundamental step for ozone protection, but presented a challenge for small-scale farmers and countries with agricultural-based economies.

In Morocco, agriculture represents around 20% of GDP, 30% of exports and encompasses close to 80% of the rural workforce.²⁸ Changes in agricultural policies therefore have a direct impact on the 13.8 million women and men living in rural communities.²⁹

Faced with the challenge of phasing-out methyl bromide without hurting the agriculture sector, the Government of Morocco partnered with UNIDO to find innovative solutions that would benefit both small-scale farmers and the environment.

In 2017, UNIDO received an 'Exemplary Project Award' from the Ozone Secretariat for its exceptional work in phasing-out methyl bromide. UNIDO has successfully implemented 175 projects in 55

developing countries for the elimination of more than 8,000 metric tonnes of methyl bromide. This represents 70% of the total phase-out of this chemical in developing countries.



Mounir Miku, a farmer in Agadir, Morocco recalls the moment the upcoming ban on methyl bromide was announced. His main concern was that the European Union – one of Morocco's largest export markets – banned the use of methyl bromide as of March 2010. This meant that local farmers urgently needed to find sustainable alternatives to methyl bromide that would allow them to continue exporting their produce.

The solutions they found with the help of UNIDO were indeed sustainable, as well as innovative and affordable. The first was to introduce biofumigation, a system based on crop rotation. Farmers alternate their cash crops – the ones they grow for the export

* Methyl bromide is still used for quarantine and pre-shipment (QPS), but countries need to obtain 'critical use' exemptions for its application. As of 2021, the recapture or destruction of methyl bromide emissions at the end of fumigation will be compulsory.

market – with plants in the Brassicaceae family, such as cauliflower and broccoli. These crops contain isothiocyanates, which are known to kill fungal diseases, so they can be used as a chemical-free fumigant.³⁰ UNIDO then introduced solarisation, another non-chemical method of controlling pests. Here, farmers cover their soil with a layer of material and then expose it to the heat of the sun. The rising temperature of the soil weakens or destroys bacteria, fungi and other pests. This method was ideal for Morocco, a country with one of the highest rates of solar insolation worldwide – about 3,000 hours of sunshine per year.³¹

Finally, UNIDO piloted the use of soilless systems. This was a big challenge for farmers, as soil contains vital nutrients. When water travels through soil, it carries these nutrients to the roots of the plant. To remove soil altogether, the farmers had to pre-mix these nutrients into a water reservoir, along with high levels of oxygen. But in traditional soil farms, only a small percentage of nutrients make it to the roots, and the rest ends up in the local water supply.

This meant that the new soilless systems were more resource-efficient than the traditional methods.

“ The fact that we managed to swiftly find alternatives was very important for the farmers. Our land and our exports are now safe. ”

Mounir Miku
Farmer in Agadir, Morocco

This process accelerated the transformation of the agricultural sector in Morocco. By the end of 2009, methyl bromide was completely eliminated from the country's tomato production. Farmers like Mounir Miku not only reduced their use of toxic chemicals, but also discovered innovative methods to make better use of their resources –for the good of their businesses and the planet.

Protecting the environment and securing palm dates industry in Tunisia



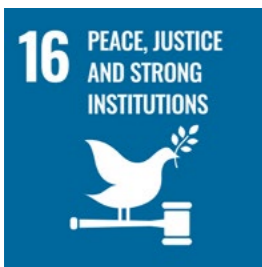
These activities were carried out in the framework of the “Phase-out of methyl bromide used as a soil fumigant in the production of green beans

and cucurbits” and “Phase-out of Methyl Bromide used for soil fumigation for Moroccan tomato production” projects, funded by the **MLF**.

Toolkit Sustainable compliance with the methyl bromide phase-out

Video Video on methyl bromide phase-out in Morocco

Factsheet Phase-out of Methyl Bromide used for soil fumigation for Moroccan tomato production



PEACE, JUSTICE & STRONG INSTITUTIONS

Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

Sustainable development relies on the collaborative efforts of institutions across the globe. Institutions, public and private alike, shape the world we live in, by enforcing progressive policies, finding innovative solutions and encouraging social inclusion.

They are also key players in international climate agreements. The Montreal Protocol relies on public institutions to develop and enforce the policies required to control the production and consumption of controlled substances. This responsibility falls primarily on the operational focal points, known as National Ozone Units (NOUs).

NOUs wear many hats. On the one hand, they enforce strict policies to control the export, import and production of controlled substances. On the other, they work closely with industries to find sustainable alternatives to these substances. They also support associations and higher learning institutions to deliver qualified technical training to **RAC** technicians. On a global level, NOUs are

responsible for reporting on the country's progress towards their Montreal Protocol commitments and sharing their experiences with other nations.

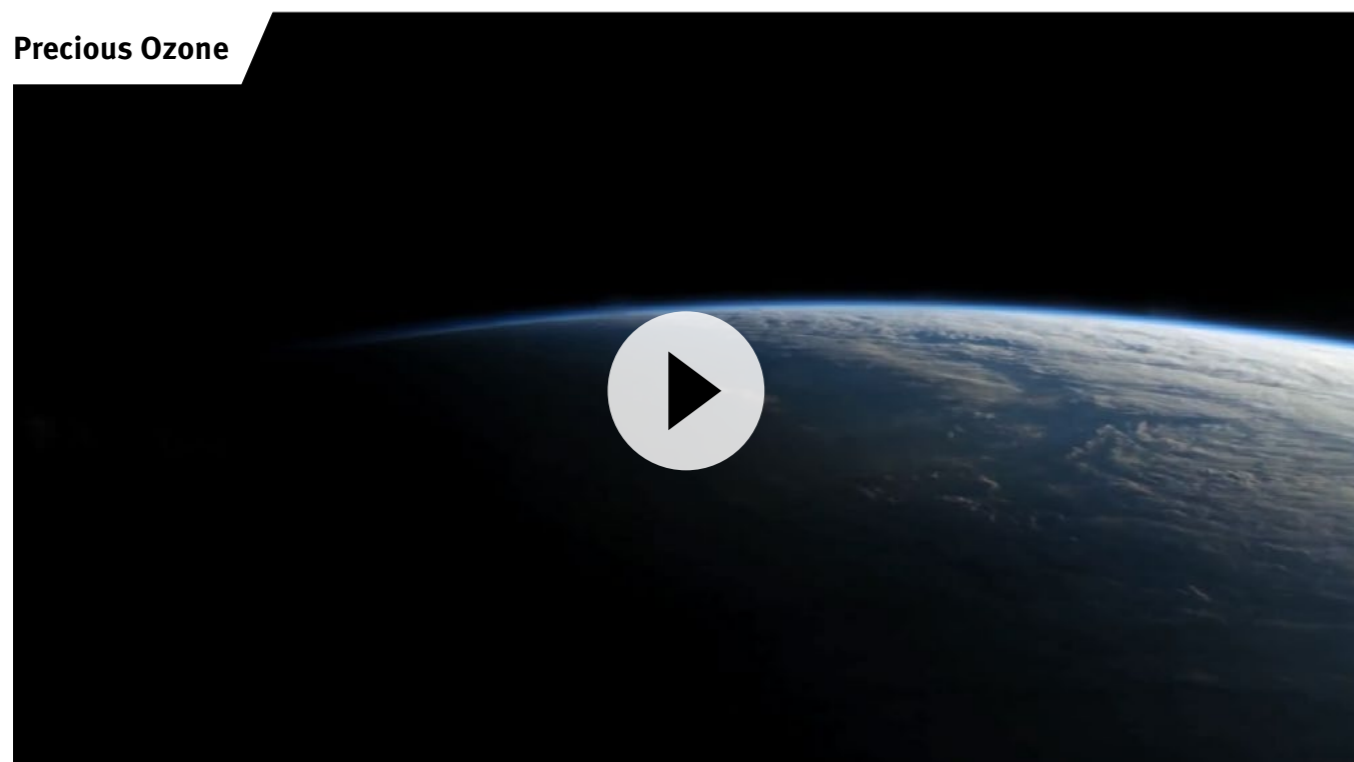
Montenegro ratified the Vienna Convention and the Montreal Protocol, along with its Amendments, on 23 October 2006, only 4 months after declaring its independence and becoming a sovereign Member State of the United Nations.

The Government of Montenegro has since maintained this momentum, taking on ambitious phase-out targets and ratifying the Kigali Amendment to the Montreal Protocol the year it entered into force.

UNIDO has worked hand-in-hand with the NOU of Montenegro since 2007, providing dedicated technical assistance, training and policy advice to the Government to support them in meeting their obligations under the Montreal Protocol.

[View SDG 16 Targets](#)

Precious Ozone



This partnership began with an 'Institutional strengthening' project to support the implementation of the Montreal Protocol in Montenegro. Here "institutional strength" refers to the collective capacity of different institutions working towards one goal. UNIDO and the NOU outlined the roles of each group of stakeholders – from the Montenegro Customs Administration to the technical vocational schools – and set out to equip them with the knowledge and tools they would need to contribute to the Montreal Protocol activities.

With UNIDO's support, the NOU of Montenegro developed a robust policy framework for the control of HCFCs, collected and disseminated information on sustainable alternatives, and developed manuals and training materials for technicians in the RAC sector. At present, UNIDO and the NOU are working directly with vocational schools in Montenegro to deliver technical seminars and training courses on good practices in refrigeration.

Building on this successful partnership, UNIDO and the NOU of Montenegro launched an 'Enabling activities' project to prepare for the ratification and

early implementation of the Kigali Amendment. A key step in this process was to understand the implications of the Kigali Amendment on policies, standards, and business models. UNIDO delivered a 2-day multi-stakeholder workshop on the Kigali Amendment, outlining the necessary changes to national policies, institutional arrangements and licensing systems. Then UNIDO outlined the process for adopting international standards. Finally, UNIDO highlighted the growing importance of energy efficiency under the Kigali Amendment. This included information on how to integrate energy efficiency in business models; how policies on energy management systems can stimulate the uptake of energy efficiency and how this is instrumental to achieving the goals of the Kigali Amendment. In April 2019, Montenegro officially became the 70th country to ratify the Kigali Amendment.

This journey gives us a glimpse of the dedicated work and commitment behind the Montreal Protocol. From this we can appreciate the role institutions play and understand why we must give them the tools and 'institutional strength' to put our ambitious climate goals into action.

These activities were carried out in the framework of the Institutional Strengthening and Enabling Activities projects for Montenegro, funded by the **MLF**.

UNIDO's Institutional Strengthening projects span 15 countries (as part of HPMPs or as stand-alone

projects) and UNIDO's Enabling Activity projects encompass 31 countries. The enabling activities are designed to help countries ratify the Kigali Amendment and set up the legal and institutional framework needed for the HFC phase-down.

Booklet [Ozone and You](#)

Article [Training on refrigeration best practices](#)

Website [National Ozone Unit Montenegro](#)

Leaflet [Implementation of Montreal Protocol in Montenegro](#)



PARTNERSHIPS FOR THE GOALS

Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.

The 2030 Agenda for Sustainable Development and its 17 goals certainly set the bar high. These goals embrace all areas of human development, from poverty alleviation and food security to education, employment and climate action. Such ambitious goals can only be met with large-scale and coordinated action. In response, the global community has established strategic partnerships and aligned resources - including funding, expertise and technologies – to find joint solutions for each of these goals.

The Parties to the Montreal Protocol already form part of a global alliance on ozone and climate action. Every single country is committed to meeting binding, measurable commitments, but different groups of countries have differentiated targets and timelines. Though countries are not grouped by region, they form part of Regional Networks of

National Ozone Officers. These networks build on shared experiences and regional knowledge, enabling countries to exchange advice on how to meet their Montreal Protocol commitments.

Now, donors and implementing agencies are recognising the benefits of regional partnerships to strengthen cooperation, align public and private investment and find sustainable solutions.

At times, this can be challenging, as each country has its own rhythm, institutional framework and mind-set. But finding ways to improve regional and global partnerships is a challenge we must address. With the promise of a more sustainable future for all, the benefits outweigh the costs.

[View SDG 17 Targets](#)



Building on the momentum generated by the adoption of the Kigali Amendment to the Montreal Protocol, **GIZ** partnered with UNIDO and **UNDP** to drive coordinated action on **ODS** phase-out and HFC-phase down in 7 countries in the Latin American and Caribbean (LAC) region: Colombia, Costa Rica, Cuba, Grenada, Mexico, Paraguay and Venezuela.

The common goal of this partnership was to promote climate-friendly solutions to replace ODS and HFCs in the **RAC** sector, recognising the wide-scale environmental benefits of this. HFC emissions, released both during the lifetime of appliances (refrigerant leakages) and from end-of-life equipment in landfills, contribute directly to global warming. It is estimated that global efforts to phase-down HFCs could cut greenhouse gas emissions by 100 billion tonnes of CO2 equivalent by 2050.³²

To support these efforts on the regional level, GIZ, UNIDO and UNDP developed a comprehensive set of legislative, strategic and practical measures to catalyse the HFC-phase down in the target countries. This required specific legal and technical instruments, as well as strategies for reducing HFCs and adopting low-**GWP** alternatives. For each priority sector in each country, the partners sought out the best-suited alternatives, capitalizing on the existing capacities and finding a compromise between cost-efficiency and environmental impact.

The partners also set out to address the emissions from existing appliances run on HFCs. This included dedicated training to end-users to reduce refrigerant leakage and strategies for the management of end-of-life RAC equipment. Channelling regional knowledge sharing initiatives, the partners promoted the exchange of experiences on adopting natural refrigerants and climate-friendly technologies. Within this partnership, UNIDO worked hand-in-hand with institutions and industries in Grenada, Mexico and Venezuela to reinforce policies and develop action plans for specific sectors to adopt climate-friendly alternatives. At the regional level, UNIDO helped deliver strategies and models for increasing the availability of natural refrigerants and a framework for the disposal of end-of-life RAC equipment.

The success of this partnership can best be appreciated from the engagement of the local partners. At the launch of the “Strategy for the management of F-gases and end-of-life RAC equipment in Mexico”, 57 women and 72 men took part. At the regional level, momentum is building and propelling Latin American and Caribbean countries forwards. With each step, the ambitious targets of the Montreal Protocol and the sustainable development goals come closer within reach.

These activities were carried out in the framework of the “Sustainable and climate-friendly phase-out of ozone-depleting substances” (SPODS) project, funded by the European Commission.

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Vienna International Centre
Wagramerstr. 5, P.O. Box 300,
A-1400 Vienna, Austria



+43 1 26026-0



www.unido.org



unido@unido.org



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