



# UNIDO Expert Group Meeting Bulletin

A Summary Report of the UNIDO Expert Group Meeting on Mechanisms for the Removal of Barriers to Chiller Replacements  
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## SUMMARY OF UNIDO EXPERT GROUP MEETING ON MECHANISMS FOR THE REMOVAL OF BARRIERS TO CHILLER REPLACEMENTS: 2-4 JULY 2007

The United Nations Industrial Development Organization (UNIDO) hosted an Expert Group Meeting on “Designing Mechanisms to Facilitate the Removal of Barriers to Chiller Replacements” from 2-4 July 2007, at UNIDO Headquarters in Vienna, Austria. Organized by the Multilateral Environmental Agreements Branch, the meeting was held within the framework of UNIDO’s programme of regional chiller demonstration projects being undertaken in Africa, Eastern Europe and West Asia. This programme promotes energy efficient replacements for chlorofluorocarbon (CFC) based chillers through the stimulation of market conditions favourable to replacements.

The Expert Group Meeting (EGM) brought together 46 experts from 16 countries to discuss ways to overcome barriers to replacing CFC-based chillers, many of which commonly hinder other energy efficiency projects, with a view to identifying elements for incorporation into replacement strategies. Participants at the EGM focused on three themes: innovative chiller technologies; financial mechanisms for energy efficiency projects that could be employed in the chiller sub-sector; and regulatory support for promoting energy efficient chiller replacements. These themes were addressed through expert panel presentations and related discussions and also through deliberations in three working groups. Additionally, the meeting included a site visit to Austria’s largest cooling plant, housed at Vienna General Hospital.

The EGM produced a set of recommendations for addressing technical, financial and regulatory barriers. These recommendations will provide the basis for specific deliverables to be used by UNIDO in assisting with the preparation of national strategies for replacing CFC-based chillers, and will also be used in the preparation of a UNIDO Tool Kit on “Chiller Replacements between the Montreal and the Kyoto Protocol: Modalities for Implementation and Avenues of Financing.” Additionally, the recommendations, together with the presentations and discussions held throughout the EGM, will be incorporated into a meeting report to be prepared by UNIDO.

### A BRIEF HISTORY OF INTERNATIONAL EFFORTS TO ADDRESS OZONE LAYER DEPLETION AND CLIMATE CHANGE

**PROTECTION OF THE OZONE LAYER:** In September 1987, efforts to negotiate binding obligations to reduce the use of ozone-depleting substances (ODS) led to the adoption of the Montreal Protocol on Substances that Deplete the Ozone Layer. The Protocol introduced control measures for some CFCs and halons for developed country (non-Article 5) parties.

Developing country (Article 5) parties were granted a grace period allowing them to increase their use of these ODS before taking on commitments. The Protocol currently has 191 parties.

Since 1987, several amendments and adjustments to the Protocol have been adopted, adding new obligations and additional ODS, and adjusting existing control schedules. Under the current control schedules, non-Article 5 parties were required to phase out production and consumption of: halons by 1994; CFCs, carbon tetrachloride (CTC), hydrobromofluorocarbons and methyl chloroform by 1996; bromochloromethane by 2002; and methyl bromide by 2005. Hydrochlorofluorocarbon (HCFC) consumption is to be phased out by 2030 (with interim targets prior to those dates), with production to have been stabilized by 2004. Article 5 parties were required to phase out production and consumption of bromochloromethane by 2002. These parties must still phase out: production and consumption of CFCs, halons and CTC by 2010, and methyl chloroform and methyl bromide by 2015; and consumption of HCFCs by 2040 (with interim reduction targets prior to phase-out). HCFC production in Article 5 countries must be stabilized by 2016. As for non-Article 5 parties, there are exemptions to these phase-outs to allow for certain uses lacking feasible alternatives or in particular circumstances.

**Multilateral Fund:** The Multilateral Fund for the Implementation of the Montreal Protocol (Multilateral Fund) was established at the second Meeting of the Parties (MOP) to the Montreal Protocol to meet the incremental costs incurred by Article 5 parties in implementing the Protocol’s control measures. It also finances clearinghouse functions, including technical assistance, information, training, and the costs of

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the Multilateral Fund Secretariat. It is replenished every three years, having received a replenishment of US\$400.4 million for the period 2006-2008.

**UNIDO:** The UN organization responsible for industrial development, UNIDO, is one of four "implementing agencies" of the Multilateral Fund. Established in 1966, it became a specialized agency of the UN in 1985 and has 172 member states. Its work in the area of the Montreal Protocol comprises one of its eight "Service Modules." This Module includes the provision of: services in policy, strategy and programme design; institutional support; and enterprise- and country-level technical assistance.

**Chiller Replacements:** Chillers are refrigeration systems that produce chilled water for cooling air in commercial, residential and industrial processes or in food preservation. Traditionally, chillers have used CFC-based refrigerants, one of the ODS controlled by the Montreal Protocol. Replacing CFC chillers with new, more efficient CFC-free alternatives ("chiller replacements") can reduce electricity consumption and peak electrical demand, thereby reducing greenhouse gas emissions while also contributing to the phase-out of CFCs. However, such replacement chillers are being adopted at a low rate in Article 5 countries, in large part due to barriers such as high initial investment costs, a lack of conducive government policies, deficiencies in technical know-how and limited access to finance. Research and experience suggest chiller replacement projects should target the setup of financial schemes to overcome such technical, regulatory and financial barriers, which are common in the financing of energy efficiency projects.

At MOP-14 in November 2003, parties requested the Technology and Economic Assessment Panel (TEAP) to collect global data on and assess problems related to CFC phase-out in the chiller sector, and to identify incentives for the adoption of non-CFC equipment. Based on the TEAP's findings, the Executive Committee of the Multilateral Fund (ExCom), at its forty-fifth meeting in December 2004, requested the Multilateral Fund Secretariat to prepare a study on the modalities that may be applied for the development of chiller projects. This report was considered at the forty-sixth ExCom meeting in July 2005 and the ExCom decided to open a limited window for the financing of CFC chiller replacement demonstration projects, conditional on the availability of external resources related to improvements in the energy efficiency of new chillers. The strategy of the new projects is to reorient chiller replacement activities under the Montreal Protocol toward the energy efficiency sector and to the financial resources potentially available in that sector. They also provide an example to the chiller sector for making use of identified strategic elements and mechanisms. As a result of further decisions taken at the forty-seventh and forty-eighth meetings of the ExCom, UNIDO is currently implementing three regional chiller demonstration projects in Africa, Eastern Europe and West Asia.

#### **THE UNFCCC AND THE KYOTO PROTOCOL:**

An international political response to climate change first took shape in 1992 with the adoption of the UN Framework Convention on Climate Change (UNFCCC). The UNFCCC sets out a framework for action aimed at stabilizing atmospheric concentrations of greenhouse gases in order to avoid "dangerous anthropogenic interference" with the climate system. The UNFCCC entered into force in March 1994 and now has 191 parties.

At the third Conference of the Parties (COP 3) in December 1997, delegates adopted the Kyoto Protocol to the UNFCCC, which commits developed countries and countries with economies in transition (Annex I parties) to achieve quantified emissions reduction targets. These countries agreed to reduce their overall emissions of six greenhouse gases by an average of 5.2% below 1990 levels between 2008 and 2012 (the first

commitment period), with specific targets varying from country to country. The Kyoto Protocol entered into force in February 2005 and now has 175 parties.

#### **The Clean Development Mechanism and Joint**

**Implementation:** The Kyoto Protocol established three flexible mechanisms to assist the parties in meeting their national targets cost-effectively: an emissions trading system; Joint Implementation (JI); and the Clean Development Mechanism (CDM).

The CDM allows Annex I parties to invest in project activities that reduce emissions in non-Annex I parties, in return for certified emission reductions (CERs). The CERs accrued from the year 2000 onwards can be used by Annex I parties to help meet their emissions targets for the first commitment period. Article 12 of the Kyoto Protocol stresses that such project activities are to assist the developing country host parties in achieving sustainable development.

Under JI, an Annex I party may implement an emissions-reducing project or a project that enhances removals by sinks in the territory of another Annex I party and count the resulting emission reduction units (ERUs) towards meeting its own Kyoto target. An Annex I party may also authorize legal entities to participate in JI projects.

### **MEETING REPORT**

In addressing barriers to CFC-free chiller replacements, the EGM focused on technical, financial and regulatory issues. These three themes were addressed via expert panel presentations and discussions on Monday and Tuesday and through working group discussions on Wednesday morning. On Wednesday afternoon, all participants reconvened to discuss the working group outcomes and to adopt related recommendations.

This report summarizes the presentations and discussions that took place throughout the EGM, along with the recommendations adopted by participants on Wednesday afternoon.

#### **OPENING SESSION**

Chair of the opening session, George Anestis, Unit Chief, Montreal Protocol-Refrigeration and Aerosols Unit, Multilateral Environmental Agreements Branch, UNIDO, welcomed participants to the meeting on behalf of Dimitri Piskounov, Managing Director, Programme Development and Technical Cooperation Division, UNIDO. Reminding participants that in 2005 the ExCom opened a limited window for funding demonstration projects to highlight the value of replacing CFC-based chillers, he noted that replacement can contribute to the phase-out of ODS as well as the reduction of greenhouse gas emissions. He highlighted regional demonstration projects being undertaken in Eastern Europe, West Asia and Africa, noting that they represent a practical example of synergies between the Montreal and Kyoto Protocols. He also indicated that the key objective of the demonstration projects is to evaluate and demonstrate barriers to replacements, along with incentives for the removal of those barriers.

Paul Krajnik, Austrian Ministry of Agriculture, Forestry, Environment and Water Management, said the Montreal Protocol provides a sound example of how to solve global environmental problems through cooperation between developed and developing countries, and pointed to 2007 as the twentieth anniversary of the Protocol's adoption. Referring to 2010 as another milestone for the Montreal Protocol, as Article 5 parties seek to achieve phase-out of CFC consumption and production, he cautioned against complacency in relation to future successes and emphasized the need for careful management. On requirements for replacing CFC chillers, he elaborated on the need for: viable options for a final reduction strategy; innovative technologies; financing options; and appropriate regulatory frameworks.

Khaled Klaly, former Chair, ExCom, highlighted challenges to the sustainability of the Montreal Protocol, notably the final phase-out of CFC production and consumption, compliance issues and the replacement of CFC-based chillers. He emphasized the importance of the EGM, noting that it is the first to be convened in the context of the chiller demonstration project programme to consider means of overcoming barriers to chiller replacements.

Rana Ghoneim, Associate Industrial Development Officer, Montreal Protocol-Refrigeration and Aerosols Unit, Multilateral Environmental Agreements Branch, UNIDO, outlined the objectives of the meeting, namely: reviewing financial, technical and regulatory barriers to chiller replacements; assessing available technologies, including technical options; exchanging knowledge and experience of financial mechanisms that may accelerate the implementation of chiller replacements; assessing the importance of regulations for supporting chiller replacements; and discussing funding opportunities under the CDM. She also highlighted expected outcomes, including: identifying elements to assist with the development of strategies to promote accelerated chiller replacement; formulating plans to address existing and future demands for CFCs in the chiller sub-sector beyond 2010; providing technical assistance; and raising awareness on the benefits of investing in CFC-free chiller technologies. She further noted that a publication with the presentations and results of the meeting would be prepared by UNIDO.

Peter Kögler, Kommunalkredit, Public Consulting GmbH (KPC), Austria, provided an overview of the meeting's structure, indicating that it would consist of technical, financial and regulatory panels on Monday and Tuesday, and working group discussions on Wednesday.

#### TECHNICAL PANEL

The first part of the technical panel, on types, options and efficiencies of CFC and non-CFC-based chillers, and innovative chiller technologies, was chaired by Wolfgang Diernhofer, KPC, while the second part, which also concerned innovative chiller technologies, was chaired by Peter Kögler.

**TYPES, OPTIONS AND EFFICIENCIES OF CHILLERS:** Lambert Kuijpers, TEAP Co-Chair and Co-Chair of the Refrigeration Technical Options Committee (RTOC), presented on the types, options and efficiencies of chillers. Introducing the concept of chillers, he explained that they require relatively high investments depending on their type, capacity and control strategy, among other factors. He discussed types of chillers, in particular, vapor compression and absorption chillers. He then outlined chiller capacity ranges and the technical features of various chiller refrigerants, including HCFC-22, HCFC-123, HFC-134a, R-407C, R-410A, ammonia, and centrifugal chillers. He discussed the numbers of CFC-based chillers in use globally and noted options for the retention, containment, retrofitting or replacement of CFC chillers. He explained that the environmental impacts of chillers mostly relate to energy consumption and refrigerant leakage. He discussed energy efficiency considerations, explaining that the payback on new chillers could be three to five years depending on, *inter alia*, the annual running time and electricity prices. TEAP Co-Chair Kuijpers concluded by noting that: chiller refrigerant options are multiple; chillers include much more than centrifugals; choices for replacements depend on the strategy developed and followed; and energy use and efficiency is the predominant consideration but this also relates to the total design of the central system.

Stephan Sicars, Multilateral Fund Secretariat, presented on options and barriers regarding chiller replacements. On challenges posed by the use of centrifugal chillers in developing countries, he said old CFC chillers are inefficient and have poor maintenance records, and emphasized the economic benefits of chiller replacements in terms of energy

savings and increased reliability. He also elaborated on additional benefits to owners, electrical power suppliers, manufacturers and the global environmental community. On barriers to further replacement and related investments, he highlighted: information gaps regarding the impending CFC phase-out; uncertainty surrounding potential energy savings; competing investment priorities; and prohibitive interest rates. He also discussed incentives for replacing chillers, such as the provision of loans, subsidies and tax breaks, and the relevance of incorporating minimum energy efficiency standards into building codes.

**Discussion:** In the ensuing discussion, participants focused on the importance of overall energy efficiency in considering chiller replacements. They also discussed the reason for the relatively high number of absorption units in Asia, which they said mostly relates to prevailing electricity prices. Additionally, participants pointed out that some owners prefer to pay the long-term maintenance costs of using old chillers rather than switch to CFC-free units, which would involve a large capital outlay.

**INNOVATIVE CHILLER TECHNOLOGIES - PART I:** Christian Holter, Solar Installation and Design (S.O.L.I.D. GmbH), Austria, presented on solar-powered cooling, pointing out that solar thermal power has developed rapidly worldwide and noting the potential of solar cooling. He cited examples of solar cooling, including: a renewable energy house in Brussels; a desert outdoor center in the US; and the Olympic sailing village in China. Highlighting that solar cooling is a safe and accessible technology and that such chillers have a long lifespan, he said solar cooling should be a major aspect of solar energy development. He suggested that future strategies for advancing solar energy could include: developing financing mechanisms; taking an incremental approach; evaluating market potential; developing regional pilot projects; and raising awareness of relevant technologies and possibilities.

Marco Matteini, UNIDO Consultant, discussed the potential of solar thermal energy technologies for air-conditioning in the Caribbean. He discussed a project developed by UNIDO's Energy and Cleaner Production Branch, in partnership with the Petroleum Corporation of Jamaica and S.O.L.I.D. GmbH, for the Energy Facility of the European Union (EU) and the African, Caribbean and Pacific group of states (ACP). He also outlined key energy challenges in the Caribbean, and the benefits of solar air-conditioning, including: reduction in electric power demand; energy savings and emission reductions; and reduced ozone-depletion potential. Elaborating on barriers to solar air-conditioning, he discussed: a lack of awareness at all levels; inadequate technical expertise; financial and regulatory barriers; and a lack of supporting policies. On the way forward, he suggested: undertaking more demonstration projects; raising awareness and promoting solar air-conditioning among key stakeholders; minimizing barriers to market creation and development; and establishing innovative, dedicated financing.

**Discussion:** Christian Holder clarified that lithium bromide machines are often used for solar applications, but that for process cooling ammonium may also be used, requiring temperatures of 75 to 90 degrees Celsius. He further observed that the per tonne investment in solar projects may be high, depending on the size of the project. Stephan Sicars suggested it may be meaningful, when discussing incentives, to consider how far proposed solutions might be able to go from business-as-usual scenarios. Marco Matteini noted the need to identify an appropriate methodology in the case of CDM projects. Participants also discussed the questions of what payback period is necessary for ensuring the viability of a project and how to motivate chiller owners and users to switch to replacements where CFC-based systems continue to function smoothly.



## **INNOVATIVE CHILLER TECHNOLOGIES - PART II:**

Alaa Olama, Egyptian Company for Refrigeration by Natural Gas (Gascool), provided an overview of absorption chiller technology in Egypt. On the disadvantages of absorption chillers when compared with mechanical vapor compression chillers, he noted that absorption chillers: are bulkier than comparable mechanical vapor compression models; respond sluggishly to rapid variable loads; and require large quantities of water for cooling. Regarding advantages, he highlighted: savings of 20-30% of electricity; relatively low operation noise levels; reduced mechanical wear; and the environmentally friendly nature of using water as a refrigerant. He also explained district cooling and heating, which entails the centralized production and distribution of cooling or heating energy and which is more cost effective than cooling individual buildings. He then outlined two such projects, a "smart village" in Cairo, and the district cooling and heating and co-generation facility at the American University in Cairo.

Alexander Wallisch, Fernwärme Wien GmbH, Austria, presented on district cooling in Vienna. He introduced his company's "TownTown Project," which makes use of waste heat to power a chiller plant. He explained that the project uses both absorption and compression chillers for economic reasons, using efficient absorption chillers, and also using water drawn from the Danube River during the cooler months. Observing that Austria's electricity consumption during summer is very high, he noted the need for reducing the plant's electricity usage through employing an absorption, rather than a compression, system. He also highlighted key factors for the success of district cooling, such as re-cooling techniques and the use of free cooling resources, surplus heat for absorption, and other cheap heat resources. He pointed out that district cooling provides a solution for customers with high cooling demands and high full-load operating hours.

Johann Geyer, Renet Güssing GmbH, Austria, outlined biomass district heating and cooling research and demonstration plants in operation in Güssing, Austria, which utilize biomass produced from woodchips and sawdust. He explained that absorption systems are more sensitive to ambient operating conditions as compared with compression systems, and also acknowledged drawbacks such as the cost implications relating to the amount of electricity required to operate the cooling tower within the absorption system. He elaborated on a prototype test system, which he said is operating efficiently but needs further research and development. Regarding the weaknesses of such a system, he noted its bulkiness, the slow rate of heat exchange for absorption, and the high investment costs and low energy efficiency.

**WRAP UP:** George Anestis wrapped up the day's proceedings, noting that the opening session provided participants with an opportunity to review the rationale and challenges for chiller replacements, while the presentations and discussions during the technical panel sessions allowed participants to review the various technical aspects and options for chiller replacement.

## **TOUR OF CHILLER PLANT AT VIENNA GENERAL HOSPITAL**

On Monday afternoon, participants took part in a tour of Austria's largest cooling plant, housed at Vienna General Hospital. The tour commenced with a viewing of a model of the entire hospital, which is one of the biggest in Europe, incorporating medical clinics of Vienna University. Participants then toured "Central Chilling Plant II," which is fully automated, comprises four larger and 2 smaller chillers, produces 7.5 million cubic meters of cool air per hour and has an annual consumption of 160 gigawatt hours. Finally,

participants toured the chiller plant control room, which is automated but can be switched to manual operation if necessary.

## **FINANCIAL PANEL**

The first part of the financial panel, which focused on public-private partnerships, grant and financing sources and the Kyoto Protocol's flexible mechanisms, was chaired by Rana Ghoneim, while the second part, which addressed commercial financing, was chaired by Alexander Linke, KPC.

**PUBLIC-PRIVATE PARTNERSHIPS:** Vladimir Soldo, on behalf of HEP ESCO d.o.o., Croatia, presented on public-private partnerships in the context of energy service contracting. He observed that the market potential for energy projects in Croatia is growing, due to rising oil, gas and electricity prices. He explained that HEP ESCO, a Croatian electricity company, develops, implements and finances energy efficiency projects with the aim of developing a sustainable market for such projects. He said sectors of interest include: buildings, such as offices, hotels and hospitals; public lighting; industry; and energy supply systems, such as co-generation and district heating. He noted the company's cooperation with UNIDO on a demonstration project for the replacement of four chillers in Croatia.

**GRANT AND FINANCING SOURCES:** Highlighting that the Global Environment Facility (GEF) provides incremental funding for projects with global environmental benefits, Zhihong Zhang, GEF, discussed the GEF's experience in projects financing chiller replacement activities in Brazil and Thailand. He explained that the project in Brazil, on market transformation for energy efficiency in buildings, was approved by the GEF Council in June 2007 and its implementation has not yet commenced. Regarding the project on building chiller replacements in Thailand, he detailed the financial contributions provided by the GEF and the Multilateral Fund and noted that the project was completed in 2005. He stated that the results of the Thailand project include: the replacement of 17 CFC-based chillers, with a corresponding reduction of 39 ozone-depletion potential (ODP) tonnes of CFC over 17 years; the reduction of 58 kilotonnes of carbon equivalent from energy savings over 17 years; and annual energy savings of 15,350 megawatt hours. He also described difficulties in implementing this project, such as the stringent technical criteria applied, minimal flexibility within the loan program, lack of technical support, high transaction costs and the precarious financial situation in Thailand at the time the project was being implemented. Concluding that the results of the project justified the GEF's financial contribution, he noted that it was successful in achieving its demonstration effect and in exceeding expectations regarding energy savings, greenhouse gas and ODS reductions, replacement costs and financial returns.

**KYOTO FLEXIBLE MECHANISMS:** Wolfgang Diernhofer explained that KPC acts as a partner for public sector clients in Austria and elsewhere, and that among its operations it manages Austria's JI and CDM programme on behalf of the Australian Ministry of Agriculture, Forestry, Environment and Water Management. He discussed how carbon buyers can provide additional financial resources for energy efficiency projects. He also discussed the current status of energy efficiency projects under the CDM and JI, and possible reasons why there are relatively few such projects under the CDM and JI. He outlined ways that Kyoto's flexible mechanisms might contribute to chiller replacement activities, along with options for chiller replacement projects under both the CDM and JI. He also highlighted the possibility of using "alternative options" under the CDM and JI, notably, the registration of a programme of activities (PoA) as a CDM project, and the Green Investment Scheme, which involves

the sale of surplus assigned amount units (AAUs) by Annex I parties. He concluded by noting, that, *inter alia*: JI and CDM projects may contribute to chiller replacement activities, including through “alternative options”; JI and CDM projects involve high initial transaction costs and require approved methodologies; and financial incentives for chiller replacement projects may be relatively low and projects involving small amounts of CERs and ERUs may be difficult to market.

**Discussion:** During the ensuing discussion, George Anestis informed participants that UNIDO, in collaboration with the GEF, is involved in the persistent organic pollutants sector, particularly in the context of developing National Implementation Plans (NIP) and post-NIP investment projects and activities. He also noted that further projects are being developed in relation to climate change, energy efficiency and greenhouse gas emission reductions, in addition to projects in the renewable energy sector in Latin America and Africa. He further noted that, under the GEF, UNIDO is executing projects in the area of international waters management.

Responding to a question on the rate of return on investment, Vladimir Soldo said energy service companies (ESCOs) typically consider sites where investments can be recovered within eight years. One participant enquired why only 17 out of the 24 intended chillers were replaced in the Thailand project supported by the GEF. Zhihong Zhang responded that the rigid design of the loan programme resulted in the project no longer being attractive to chiller owners during the Thai financial crisis, given falling interest rates, but reiterated that the project nonetheless achieved its objectives.

**COMMERCIAL FINANCING:** Pia Musil, KPC, presenting on behalf of Dexi Bank, Austria, explained that Dexi Bank provides long-term financing solutions to public authorities and companies, mainly in Central and Eastern Europe. She said that in these regions, significant investments are required by local authorities to meet European standards and to achieve compliance with European directives. She further explained that improving economic performance in these regions facilitates investment in energy efficiency projects. She elaborated on bank products and services, such as the purchase of receivables from suppliers on behalf of the public sector, with the public sector repaying the bank instead of the supplier. She also outlined the pre-financing of subsidies and grants for the bank’s clients.

Mohamed Aly, National Bank of Egypt (NBE), said that as the biggest financial bank in Egypt, NBE is committed to environmental protection and provides substantial funding for environmental projects through environment credit lines. Mohamed Madkour, NBE, noted that there are 200 to 300 chillers in Egypt, mostly located in hotels, shopping centers and hospitals, the majority of which are NBE customers. He outlined barriers to chiller replacement in Egypt, including: lack of awareness; inadequate self-financing capacity; insufficient cash flows for covering costs; and a lack of information on the costs and benefits of financing chiller replacements. He described the NBE’s plan for financing chiller replacements, including establishing a specialized window for CDM and chiller replacement projects within the credit division of NBE and cooperating with international institutions to build its capacity and increase its business in this area. He also outlined financial mechanisms being considered by NBE for chiller replacement, including grants, partial chiller replacement guarantees and soft loans combined with commercial loans.

Michael Plechaty, VA Tech Finance GmbH, Austria, outlined the services that VA Tech Finance can provide in: acting as an “arranger/advisor”; conducting feasibility studies and developing project information and memoranda; providing project development services for Austrian and international projects; and advising on securities for the co-financing of energy efficiency projects. He also discussed his company’s

expertise in the area of JI and CDM projects, and elaborated on a JI project undertaken by Austria and Bulgaria at the Tsankov Kamak Hydro Electric Power Plant in Bulgaria. He explained the financing arrangements and the Kyoto Protocol aspects of the project. Describing the project as a “win-win” for both countries, he noted that for Austria it involved an “export increase,” the purchase of ERUs, and a higher level of cover by the Austrian Export Credit Agency (OeKB), while for Bulgaria gains included “green, clear energy,” a reduction in carbon dioxide emissions, job creation and the transfer of relevant know-how.

**Discussion:** Referring to barriers mentioned by NBE, a participant enquired about the potential actors and modalities for removing these, and questioned whether the provision of individual grants to replace chillers could really be considered to be a means of removing barriers. Mohamed Aly and Mohamed Madkour responded that governments could incentivize chiller replacement by, for example, providing tax breaks. They also stressed the need for capacity building to assist in the calculation of chiller replacement benefits.

### REGULATORY PANEL

The first part of the regulatory panel, which considered UNEP’s Global Awareness Programme and the European regulatory framework for conventional and alternative refrigerants, was chaired by George Anestis. The second part, chaired by Werner Gargitter, KPC, considered regulatory case studies.

**UNEP GLOBAL AWARENESS PROGRAMME:** Yerzhan Aisabayev, UNEP Division of Technology, Industry and Economics (DTIE), presented on UNEP’s Global Chiller Demonstration Project, which focuses on awareness raising and information dissemination in relation to the chiller sub-sector. He said the project aims to contribute to the “technology switch” required for moving to ODS alternatives in this sub-sector and to disseminate information for raising awareness among decision makers, legislators, the public and private sectors, media and students in Article 5 countries. He outlined particular project activities, including: compiling information on the technical and financial options and benefits and costs of different chillers from existing reports, research results and technical documentation; consulting with other implementing and bilateral agencies, industry representatives and associations; establishing and operating the Global Chiller web portal; producing awareness-raising kits for policy makers and chiller owners; producing a chiller replacement CD-DVD; organizing a global chiller conference; and organizing regional thematic meetings.

**EUROPEAN FRAMEWORK AND ALTERNATIVES TO CFC REFRIGERANTS:** After providing an overview of refrigerants, Robert Krawinkler, Austrian Energy Agency, discussed the characteristics of halocarbon refrigerants and their environmental impacts, including their ODP and global warming potential (GWP). He outlined options for the substitution of halocarbon refrigerants so as to allow for the continued use of existing equipment, which he said must take account of economic and ecological considerations. He also elaborated on the European regulatory framework for conventional refrigerants, and the likely developments and outlook for this sub-sector. In this context, he informed participants that from 1 January 2011, there will be no type-approval for vehicles fitted with air-conditioning systems containing fluorinated greenhouse gases with a GWP of more than 150. On alternatives to CFC refrigerants, he mentioned: carbon dioxide technologies; halogen-free refrigeration; and thermal cooling methods, such as absorption, adsorption, and desiccative and evaporative cooling.

**EGYPTIAN EXAMPLE:** Walid Soliman, Egyptian Environmental Affairs Agency, outlined the Egyptian strategy for the chiller sector. He noted that there are 230 chillers using

75 tonnes of CFCs for refilling purposes, and that replacing them would reduce power consumption by 30%. He explained that in the context of UNIDO's African chiller demonstration project, the Egyptian Government has established a project management unit and developed a national strategy for replacing CFC-based chillers. He said this project management unit aims to: facilitate the implementation of legislation to assist in project implementation; provide incentives for chiller owners, such as the reduction of import charges; and introduce new technologies for ozone friendly chillers.

**GTZ CASE STUDIES:** Presenting principles and case studies concerning regulatory frameworks and barriers to chiller replacements, Juergen Usinger, GTZ, Germany, observed that lessons can be learned from the renewable energy sector. He discussed options for regulations, economic instruments and voluntary agreements. On regulations, he noted that a wide range of regulations may be relevant to chiller replacement, such as energy efficiency performance standards, mandatory recycling requirements and obligations to use certified companies for servicing chiller installations and equipment. Presenting country case studies, he highlighted the transformation of the energy efficiency market in Brazil, which resulted from the government adopting policies and measures emphasizing energy efficiency, including a regulation mandating electricity distribution companies to invest in research and development and in energy efficiency programmes. Pointing to the situation in Mauritius, he highlighted the imposition of a 30% customs duty on CFC use and equipment and the existence of tax exemptions for ozone friendly products.

He concluded by highlighting that most of the regulatory examples provided are mainly applied in non-Article 5 countries.

**Discussion:** Juergen Usinger highlighted various obstacles relating to the take-back system for recycling CFCs, such as high costs and the lack of incentives for reclaiming CFCs. Another participant raised the issue of the relevance of ESCOs and the lack of them, particularly in Africa. Juergen Usinger responded that where ESCOs are absent the supplier sometimes delivers financial services, but because the situation differs depending on local conditions there is no "universal solution."

Zhihong Zhang noted a lack of information relating to chiller replacements and said the GEF has limited experience beyond those projects mentioned in his presentation. He pointed to the usefulness of the large body of literature on energy efficiency, particularly a UNEP-World Bank study on energy efficiency financing in Brazil, China and India. One participant noted that the issue of how to remove regulatory barriers could have been further explored and Werner Gargitter responded that this would be addressed during working group discussions.

**WRAP UP:** George Anestis provided an overview of the day's proceedings, summarizing the main points made during the presentations and drawing attention to the work to follow on Wednesday.

### WORKING GROUPS

Participants divided into three working groups on Wednesday morning to address the three themes of the EGM in further detail. On Wednesday afternoon, participants reconvened in a session chaired by George Anestis to hear presentations on the outcomes of each working group and to discuss and adopt related recommendations for inclusion in the meeting report to be prepared by UNIDO. They also agreed to insert introductory text in the meeting report that requests UNEP DTIE, under its Global Awareness Programme, to take into account and disseminate the adopted recommendations.

#### GROUP ONE - TECHNICAL BARRIERS WORKING

**GROUP:** This working group was chaired by Lambert Kuijpers, with Wolfgang Diernhofer acting as Rapporteur.

Participants reported on prospects for chiller replacement in their own countries. Various participants noted that there are no technical barriers to replacement; rather, there are technical difficulties such as the technical complexities involved in installing new units. Participants also highlighted the connection between technical aspects of replacement on the one hand, and financial and regulatory aspects on the other, noting that the success of replacement depends largely on the availability of funds and on appropriate policies and regulations.

The group then reviewed the current status of chillers and noted that: conventional technologies such as compression and absorption are widely available; the retrofitting of CFC-based chillers is no longer an economically feasible option; the use of certain technologies is dependant on the energy source, the operating hours as they relate to building characteristics and climatic conditions, and chiller capacity, among others; and although chiller service and maintenance infrastructure is generally available for vapor compression types, there is a lack of experience, particularly relating to absorption chillers. Based on this analysis, the group developed a range of recommendations.

On Wednesday afternoon, Lambert Kuijpers reported on the discussions in Working Group One and participants adopted the proposed recommendations without amendment.

**Final Outcome:** In the meeting report, regarding technical barriers, EGM participants recommend that:

- recovery and recycling of CFCs could be considered for securing the necessary supply for maintaining a certain number of CFC-based chillers;
- although there is a short-term need to replace CFC-based chillers with chillers using refrigerants such as HCFCs, HFCs or ammonia, there is also a need to design a long-term strategy for the use of chillers that aims at the use of sustainable refrigerants and technologies;
- more efforts should be spent to develop systems driven by renewables;
- when replacing chillers, energy efficiency is an important aspect that necessitates the adequate examination of all components of a refrigeration system;
- there are no technical barriers to the replacement of CFC-based chillers as alternative technologies are available on the market;
- the speed of CFC-based chiller replacement is determined by national and international policies and the availability of financial resources;
- more efforts should be directed toward raising awareness regarding the need for replacing CFC-based chillers and improving in-country technical capabilities for new technologies; and
- there is a need to formulate a long-term strategy to use refrigerants and technologies that are environmentally friendly.

#### GROUP TWO - FINANCIAL BARRIERS WORKING

**GROUP:** Working Group Two was chaired by Zhihong Zhang, with Vladimir Stehlik, UNIDO Consultant, acting as Rapporteur.

Considering barriers from the perspective of chiller users and owners and other potential borrowers, participants identified: lack of, and lack of access to, commercial financing; inadequate technical know-how for selecting appropriate chiller technologies; the cost of commercial financing; and inadequate incentives for chiller replacement. From the perspective of financial institutions, participants identified a range of barriers, including: inadequate information about the new technologies involved in chiller replacement projects; lack of experience in chiller replacement projects; a lack of technical and financial information for calculating relative energy and financial savings; insufficient assistance on calculating the credit risk of the project and the client; the possible transaction costs

associated with a project; domestic regulatory uncertainty concerning chiller replacement requirements; and uncertainty as to market size and corresponding market demand.

Participants then addressed delivery mechanisms, considering the role of equipment suppliers, banks, ESCOs and builder-owner-operators (BOOs) in implementing chiller replacement projects. They noted that a combination of entities can participate in a single project.

They also addressed types, sources and uses of financing, stressing the need to consider all options, including commercial and grant opportunities, bilateral and multilateral opportunities, self-financing, revolving loans and soft funds. On grant financing, they discussed the financing procedures under the Multilateral Fund. Regarding multilateral financing, they noted that opportunities may exist under the GEF, in particular partial guarantees and technical assistance grants, and emphasized the need to identify potential energy savings so as to attract GEF support. They also discussed opportunities under the African Development Bank and the European Bank for Reconstruction and Development, which may provide loans at lower interest rates than commercial institutions. On bilateral financing, participants noted opportunities under the Agence Française de Développement (AFD), the Fonds Français pour l'Environnement Mondial (FFEM), the Japan Bank for International Cooperation, Kreditanstalt für Wiederaufbau (KfW) and the Danish International Development Agency (Danida), among others. On uses of financing, participants noted that funds may be delivered directly to a project or may be directed toward technical assistance to a government or possibly to chiller owners.

The group concluded that: there may be a distinction between real and perceived barriers; some barriers may be country-specific; financial barriers are often closely linked to technical and regulatory barriers; chiller replacement should be considered in the context of energy efficiency measures and wider financial packages; and financing should also be directed toward technical assistance.

On Wednesday afternoon, after Zhihong Zhang reported on the outcomes of Working Group Two, one participant highlighted the importance of considering co-financing, while another emphasized that the EGM was concerned with barriers relating to activities under the Montreal Protocol and that therefore it might not be relevant to consider new financing models. In response, George Anestis suggested that the two approaches are complementary, highlighting the need to consider short- to medium-term funding for the demonstration phase and longer-term funding for the replication phase when projects might more likely be driven by market principles.

Participants adopted the proposed recommendations with the insertion of an additional point that recognizes the need to consider the conditionality of co-financing.

**Final Outcome:** In the meeting report, regarding financial barriers, EGM participants recommend:

- developing country-specific approaches;
- promoting integrated chiller replacements, including considering linkages between financial, technical and regulatory barriers, combining chiller replacements with energy efficiency measures, and offering complete financial packages;
- determining the proper level of technical assistance required and the appropriate target groups; and
- considering the conditionality of various co-financing sources.

### GROUP THREE - REGULATORY BARRIERS

**WORKING GROUP:** Working Group Three was chaired by Yerzhan Aisabayev, with Rodica Ella Morohoi, Ministry of Environment and Sustainable Development, Romania, serving as Rapporteur. The group discussed regulatory barriers to chiller replacements and proposed recommendations for overcoming them. Regarding gaps in regulatory frameworks,

there was consensus among participants that while most countries have defined phase-out dates for CFCs and other ODS, these need to be supported by subsidiary legislative provisions. Other general issues discussed included the importance of: clearly assigning roles and responsibilities to all stakeholders; coordinating national priorities by mainstreaming environmental issues; and formulating a sustainable development national strategy.

On barriers, participants also noted the absence of mandatory maintenance regulations and rules, which could be overcome by reviewing and updating existing maintenance regulations. The inadequacy of enforcement of existing national legal provisions, including a lack of appropriate penalties and/or sanctions, was also identified as a major constraint which could be addressed by empowering and training relevant inspection authorities.

Regarding the lack of appropriate national standards, solutions proposed included: stipulating emission performance standards; establishing energy efficiency standards; and providing for recovery, recycling, reclamation and destruction schemes. The group also agreed on the need to address the inadequacy of education systems by enhancing capacity in general and providing specific training and reference materials on regulatory systems and energy efficiency calculations in particular. Participants proposed a range of economic instruments, such as taxes and environmental grant schemes, in light of the current lack of regulatory provisions for encouraging financial incentives to stimulate new investments. They also highlighted the issue of awareness raising through targeted programmes and activities and suggested development of an inventory of existing chillers, which would be updated regularly.

On Wednesday afternoon, following presentation of the outcomes of Working Group Three by Yerzhan Aisabayev, one participant noted the need to design simple mechanisms to facilitate the removal of barriers, such as financial facilities to reduce capital outlay. Yerzhan Aisabayev cautioned against devising generic regulatory frameworks because national conditions differ and suggested drawing on examples of best practices and adapting these to particular national circumstances. Other participants called for the establishment of national ozone units to address chiller replacement issues. Many also called for governments to send clear signals regarding their commitment to chiller replacement.

Participants adopted the proposed recommendations with minor editorial amendments.

**Final Outcome:** In the meeting report, regarding regulatory barriers, EGM participants recommend:

- reviewing and updating existing maintenance regulations;
- ensuring adequate capacity and mandate of inspection authorities, including customs authorities, to address enforcement issues;
- ensuring adequate technical capacity for service operations;
- establishing performance standards for emissions and energy efficiency;
- providing provisions for recovery, recycling, reclamation and destruction schemes;
- building capacity and designing tailored training (curricula, related textbooks and documentation) related to: the regulatory system, the calculation of energy efficiency and energy savings and efficient use of related facilities and installations;
- establishing economic instruments such as tax incentives and environmental grant schemes;
- establishing and updating an inventory of existing chillers; and
- designing targeted awareness programmes and activities aimed at groups such as service technicians, equipment suppliers and customs.

## CLOSING SESSION

George Anestis summarized the work undertaken throughout the EGM. One participant thanked UNIDO for its efforts in organizing the meeting, noting UNIDO had provided a platform for discussion of issues and recommendations to assist countries in developing chiller replacement strategies. George Anestis thanked participants for their efforts and contributions, noting that the meeting had resulted in the identification of ongoing barriers and the formulation of possible means to overcome these in the short and long term. He thanked conference services, IISD Reporting Services, KPC and Rana Ghoneim of UNIDO, and closed the meeting at 4:53 pm.

## UPCOMING MEETINGS

**NINETEENTH MEETING OF THE PARTIES TO THE MONTREAL PROTOCOL:** MOP-19 is scheduled to take place from 17-21 September 2007 in Montreal, Canada. It will be preceded by: the 39th meeting of the Implementation Committee, which will be held 12-15 September 2007; the meeting of the Bureau of the 18th Meeting of the Parties, which will take place on 15 September 2007; and a 20th Anniversary Celebration Seminar on the Montreal Protocol, which will be held on 16 September 2007. For more information, contact: Ozone Secretariat; tel: +254-20-762-3850/1; fax: +254-20-762-4691/2/3; e-mail: [ozoneinfo@unep.org](mailto:ozoneinfo@unep.org); internet: [http://ozone.unep.org/Events/19mop\\_advance\\_info.shtml](http://ozone.unep.org/Events/19mop_advance_info.shtml)

**SYMPOSIUM ON THE TWENTIETH ANNIVERSARY OF THE MONTREAL PROTOCOL:** A symposium on "Ozone Depletion: From its Discovery to Envisat and Aura," will be held in Athens, Greece, from 23-26 September 2007. At the invitation of a range of organizations, including UNEP, the World Meteorological Organization, the Academy of Athens and the National Observatory of Athens among others, individuals who have played a key role in the success of the Montreal Protocol will gather to present the latest scientific results on ozone and to discuss the implementation of the Montreal Protocol. For more information, contact: the Symposium Secretariat; fax: +30-210-349-0120; email: [zerefos@geol.uoa.gr](mailto:zerefos@geol.uoa.gr); internet: <http://www.20yearsmontrealprotocol.org/>

**UN HIGH-LEVEL MINISTERIAL MEETING ON CLIMATE CHANGE:** A high-level ministerial meeting is scheduled to take place at UN Headquarters in New York, USA, on 24 September 2007, during the UN General Assembly session. For more information, contact: Office of the President of the UN General Assembly; tel: +1-212-963-7555; fax: +1-212-963-3301; e-mail: [secretariat@unfccc.int](mailto:secretariat@unfccc.int); internet: <http://www.un.org/ga/61/>

**TWENTY-SEVENTH SESSION OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE:** IPCC-27, which will take place from 12-16 November 2007, in Valencia, Spain, will focus on the adoption of the IPCC's Fourth Assessment Report (AR4). For more information, contact: Rudie Bourgeois, IPCC Secretariat; tel: +41-22-730-8208; fax: +41-22-7-30-8025/13; e-mail: [IPCC-Sec@wmo.int](mailto:IPCC-Sec@wmo.int); internet: <http://www.ipcc.ch/>

**THIRTEENTH CONFERENCE OF THE PARTIES TO THE UNFCCC AND THIRD MEETING OF THE PARTIES TO THE KYOTO PROTOCOL:** UNFCCC COP 13 and Kyoto Protocol COP/MOP 3 will take place from 3-14 December 2007 at the Bali International Conference Center and adjacent Nusa Dua facilities, Indonesia. These meetings will coincide with the 27th meetings of the UNFCCC's subsidiary bodies and the *Ad Hoc* Working Group on Further Commitments from Annex I Parties under the Kyoto Protocol. COP 13 and COP/MOP 3 are also expected to be accompanied

by a UNFCCC Dialogue on Long-Term Cooperative Action on Climate Change and various other events. For more information, contact: UNFCCC Secretariat; tel: +49-228-815-1000; fax: +49-228-815-1999; e-mail: [secretariat@unfccc.int](mailto:secretariat@unfccc.int); internet: <http://www.unfccc.int>

## GLOSSARY

CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CFCs	Chlorofluorocarbons
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
COP/MOP	Conference of the Parties serving as the Meeting of the Parties
CTC	Carbon tetrachloride
EGM	Expert Group Meeting
ESCO	Energy service company
ERU	Emission Reduction Unit
ExCom	Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol
GEF	Global Environment Facility
GWP	Global warming potential
HBFCs	Hydrobromofluorocarbons
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
MOP	Meeting of the Parties to the Montreal Protocol
Multilateral Fund	Multilateral Fund for the Implementation of the Montreal Protocol
NIP	National Implementation Plan
ODP	Ozone-depletion potential
ODS	Ozone-depleting substances
OEWG	Open-ended Working Group
RTOC	PoAs Programme of Activities (CDM)
TEAP	Refrigeration Technical Options Committee
UNFCCC	Technology and Economic Assessment Panel
	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization



The Expert Group Meeting brought together 46 experts from 16 countries to discuss ways to overcome barriers to replacing CFC based chillers