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**Open-ended Working Group of the Parties to  
the Montreal Protocol on Substances that  
Deplete the Ozone Layer  
Forty-third meeting  
Online, 22 and 24 May and 14–17 July 2021**

## **Report of the forty-third meeting of the Open-ended Working Group of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer**

### **Addendum**

### **Online session on the continued provision of information on energy-efficient and low-global-warming technologies**

#### **Introduction**

1. Owing to the continuing coronavirus disease (COVID-19) pandemic and related travel restrictions, the forty-third meeting of the Open-ended Working Group of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer could not be held in person in Bangkok as had been planned. Instead, a number of issues were selected from the provisional agenda for online work, including energy efficiency.
2. Accordingly, an online session on energy efficiency was convened online on 16 and 17 July 2021, to consider the technical aspects of volume 2 of the Technology and Economic Assessment Panel report issued in September 2020, on the decision XXX/5 task force report on energy efficiency entitled “Volume 2: Decision XXXI/7 – Continued provision of information on energy-efficient and low-global-warming-potential technologies” (the energy efficiency report).

#### **I. Opening of the meeting**

3. The session was co-chaired by Mr. Martin Sirois (Canada) and Ms. Vizmindia Osorio (Philippines).
4. The session was opened by Ms. Osorio, at 9 a.m. (Nairobi time (UTC + 3))<sup>1</sup> on Friday, 16 July 2021.
5. The Co-Chairs welcomed representatives to the online session on energy-efficient and low-global-warming-potential technologies, which constituted the third online session of the forty-third meeting of the Open-ended Working Group. During the first session, held in May 2021, participants had considered the replenishment of the Multilateral Fund for the Implementation of the

<sup>1</sup> All times mentioned are Nairobi time (UTC + 3).

Montreal Protocol, and at the second session, the unexpected emissions of trichlorofluoromethane (CFC-11).

6. An opening statement was delivered by Ms. Megumi Seki, Executive Secretary of the Ozone Secretariat.

7. Ms. Seki, in her statement, expressed, to the parties, the Environmental Effects Assessment Panel, the Scientific Assessment Panel and the Technology and Economic Assessment Panel, the appreciation of the Ozone Secretariat for their commitment to making progress in implementing the Montreal Protocol despite the difficult circumstances created by the COVID-19 pandemic, demonstrating resilience, tolerance and understanding in the face of adversity.

8. She recalled that the report by the task force on decision XXXI/7 (energy efficiency) of the Technology and Economic Assessment Panel, which was to be considered during the present online session, had first been requested by the parties in 2019. They had asked the Panel to prepare a report addressing any new developments with respect to best practices, availability, accessibility and cost of energy-efficient technologies in the refrigeration, air-conditioning and heat-pump sectors for consideration by the Thirty-Second Meeting of the Parties in 2020. Although the issue had been deferred to 2021 because of the pandemic, the Panel had nevertheless produced the requested report in September 2020, updating it in 2021, so that the parties would have access to the latest information. On behalf of all the parties, she thanked the Panel and its task force for their initiative.

9. Noting that climate protection had become an explicit objective of the parties in adopting the adjustment to the Montreal Protocol to accelerate the phase-out of hydrochlorofluorocarbons (HCFCs) and the Kigali Amendment to the Protocol to phase down hydrofluorocarbons (HFCs), Ms. Seki recalled that the parties were addressing the issue of enhancing energy efficiency while phasing down HFCs both through the Technology and Economic Assessment Panel and under the Multilateral Fund. The international community was still lagging behind in the achievement of its climate goals, and it would take time to switch entirely to clean energy. Energy efficiency was thus attracting increasing interest, because it could play a significant role in cutting emissions in the near term. In the long term, too, doing so would be important in reducing the demand for energy and preventing the overload of clean power networks. Demand for energy was soaring, particularly in the refrigeration and air-conditioning sector, which was estimated to account for 25 to 30 per cent of total energy consumption worldwide. The demand for cooling was predicted to increase 30-fold by 2100, as living standards rose in developing countries. Demand for space cooling was also increasing owing to the record heatwaves and other impacts of climate change being experienced around the world. Ensuring that cooling was energy-efficient, effective and sustainable would contribute not only to climate-change mitigation, but also to several of the targets of the Sustainable Development Goals. The rising demand for cooling needed to be met without warming up the planet.

10. The report by the task force of the Technology and Economic Assessment Panel was a key step in providing parties with the information they needed to take decisions towards such goals. The discussion at the present online session would serve as the basis for moving ahead with the energy efficiency agenda at the combined twelfth meeting (part II) of the Conference of the Parties to the Vienna Convention and the Thirty-Third Meeting of the Parties.

## II. Organizational matters

### A. Attendance

11. The following parties to the Montreal Protocol were represented: Albania, Algeria, Antigua and Barbuda, Argentina, Australia, Austria, Azerbaijan, Bahrain, Barbados, Belarus, Belgium, Bosnia and Herzegovina, Botswana, Brazil, Brunei, Bulgaria, Cabo Verde, Cambodia, Canada, Chile, China, Colombia, Costa Rica, Cuba, Czechia, Democratic People's Republic of Korea, Denmark, Dominican Republic, Ecuador, Egypt, Estonia, Eswatini, European Union, Finland, France, Gabon, Gambia, Germany, Ghana, Greece, Guinea, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Kuwait, Latvia, Liberia, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Maldives, Mauritius, Mexico, Micronesia (Federated States of), Montenegro, Morocco, Netherlands, New Zealand, Nicaragua, Nigeria, North Macedonia, Norway, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Republic of Korea, Romania, Russia, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Saudi Arabia, Senegal, Serbia, Sierra Leone, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Timor-Leste, Trinidad and Tobago, Tunisia, Uganda, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Venezuela (Bolivarian Republic of), Viet Nam, Zimbabwe.

12. The following United Nations entities, organizations and specialized agencies were represented: United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), United Nations Industrial Development Organization (UNIDO), World Meteorological Organization (WMO). The Montreal Protocol assessment panels and the secretariat of the Multilateral Fund for the Implementation of the Montreal Protocol were also represented.

13. The following intergovernmental, non-governmental, industry, academic and other bodies and organizations were represented: Carrier, Daikin, Environmental Investigation Agency, German Agency for International Cooperation, Industrial Technology Research Institute, Institute for Governance and Sustainable Development, Japan Refrigeration and Air Conditioning Industry Association, Natural Resources Defense Council.

## **B. Adoption of the agenda**

14. The Working Group adopted the following agenda for the online session on the basis of the full provisional agenda for the forty-third meeting of the Open-ended Working Group set out in document UNEP/OzL.Pro.WG.1/43/1 and the shortened provisional agenda specific to the online session on energy-efficient and low-global-warming-potential technologies set out in document UNEP/OzL.Pro.WG.1/43/2/Add.3:

1. Opening of the session.
2. Organizational matters:
  - (a) Adoption of the agenda;
  - (b) Organization of work.
3. Continued provision of information on energy-efficient and low-global-warming-potential technologies.
4. Closure of the meeting.

## **C. Organization of work**

15. The Working Group agreed to the organization of work proposed by the Co-Chairs, namely, to focus exclusively on item 12 of the agenda for the forty-third meeting of the Open-ended Working Group, on energy-efficient and low-global-warming-potential technologies. A presentation would be made on both days of the session by the task force on energy efficiency of the Technology and Economic Assessment Panel, to be followed by a discussion session.

## **III. Continued provision of information on energy-efficient and low-global-warming-potential technologies**

16. Introducing the item, the Co-Chairs drew attention to documents UNEP/OzL.Pro.WG.1/43/3/Rev.1 and UNEP/OzL.Pro.WG.1/43/2/Add.3, which summarized the background to the issue. The Co-Chairs recalled that, in decision XXXI/7, on continued provision of information on energy-efficient technologies, the Thirty-First Meeting of the Parties had requested the Technology and Economic Assessment Panel to prepare a report for consideration by the Thirty-Second Meeting of the Parties addressing any new developments with respect to best practices, availability, accessibility and cost of energy-efficient technologies in the refrigeration, air-conditioning and heat-pump sectors as regards the implementation of the Kigali Amendment. In response to that decision, the panel had established a task force to prepare the report. Owing to the COVID-19 pandemic, it had been decided that the Thirty-Second Meeting of the Parties would be convened online, with a reduced agenda, and that issues related to energy efficiency would instead be included in the agenda of the forty-third meeting of the Open-ended Working Group, in 2021. Nevertheless, the task force had prepared its report as originally planned in order to provide the parties with ample time to consider its findings before their formal discussions in July 2021. In that report, which was set out in volume 2 of the September 2020 report of the Technology and Economic Assessment Panel, the task force had indicated that it would provide an updated report if sufficient new information were to become available before the forty-third meeting of the Open-ended Working Group. The task force had indeed produced that update, which was set out in volume 4 of the May 2021 report of the Technology and Economic Assessment Panel. The executive summary of the updated report and a summary of the information contained in the full report were set out in the annex to document UNEP/OzL.Pro.WG.1/43/3/Rev.1.

17. The Secretariat had established a dedicated online forum on the issue of energy efficiency to enable parties to post questions and comments on the report by the task force prior to the online session on the topic. Parties would also have the opportunity to pose further questions and make further comments during the session.

## **A Presentation of the Technology and Economic Assessment Panel May 2021 report on energy efficiency**

18. In a pre-recorded video, the co-chairs of the Technical and Economic Assessment Panel task force on decision XXXI/7 (energy efficiency), Mr. Roberto Peixoto, Ms. Hélène Rochat and Mr. Ashley Woodcock, and task force members Mr. Omar Abdelaziz, Ms. Gabrielle Dreyfus, Mr. Bassam Elassaad and Mr. Ray Gluckman, presented the report of the task force, as set out in volume 4 of the Technical and Economic Assessment Panel's May 2021 report. A summary by the Panel of its presentation is set out in the annex to the present report, without formal editing.

## **B. Discussion session**

19. Representatives who took the floor thanked the energy efficiency task force of the Technology and Economic Assessment Panel for its report and for the presentation summarizing the contents of that report.

20. Members of the task force responded to a number of questions posted by parties in the online forum or raised during the present online session.

### **1. Faster action, including leapfrogging**

21. Responding to a question on how to encourage faster action towards HFC phase-down and the introduction of energy-efficient alternatives, Ms. Hélène Rochat said that that would require putting in place a supportive regulatory environment with appropriate funding support. Preliminary modelling showed the importance of early action in preventing growth in the use of high-global-warming-potential (GWP) HFCs. She noted that a number of questions related to faster action, including leapfrogging to lower-GWP alternatives and adopting a "fast mover" status, could form the basis of future work by the energy efficiency task force. On the specific question of the funding architecture, the Technology and Economic Assessment Panel and the task force could provide support to the continuing discussions related to additional financing under the Multilateral Fund.

22. In response to a question on the challenge of technology lock-in facing parties operating under paragraph 1 of Article 5 of the Montreal Protocol (Article 5 parties) with a large installed base of low-energy-efficiency equipment (executive summary and chapter 4), Ms. Rochat said that putting a strong regulatory environment in place could prevent the installation of a large base of low-energy-efficiency, high-GWP refrigeration, air-conditioning and heat pump equipment. Early action could prevent late lock-in and avoid a situation whereby inefficient power generation resulted in substantial economic disadvantage and many years of servicing needs for systems using high-GWP chemicals.

23. Responding to a question about the availability of new technologies for domestic air-conditioning, for example those using HFC-32 as a refrigerant, and the time lag in technology transfer to Article 5 parties from non-Article 5 parties, Mr. Bassam Elassaad said that technologies using HFC-32 had been introduced in Europe and Japan, for example, as low-GWP alternatives in smaller-capacity equipment, and other developments were taking place that also considered energy efficiency. Regarding the transfer of technology, leapfrogging offered the opportunity to accelerate the transfer of new technologies to Article 5 parties, assisted by developments in the infrastructure and knowledge base related to technology transfer. Ms. Gabrielle Dreyfus added that there was a need to start planning, as shown in the modelling for those sectors for which technologies were readily available, as laid out in present and previous reports of the Technology and Economic Assessment Panel. She acknowledged that the current environment of rapid change put pressure on the national ozone units, noting that commensurate resourcing would assist in facilitating planning for the transition.

### **2. Addressing barriers, including safety concerns**

24. On the matter of barriers to leapfrogging from HCFC-based refrigerants to low-GWP refrigerants (section 3.5.4), Ms. Rochat said that such barriers included lack of enabling policies and regulatory and market signals; lack of readiness of the servicing sector to handle more flammable

refrigerants; and lack of awareness, particularly in Article 5 parties. Financial support would help to overcome those barriers.

25. In response to a question on how safety concerns had been addressed in non-Article 5 parties, including the flammability of low-GWP alternative refrigerants for refrigeration, air-conditioning and heat pump applications, Mr. Elassaad said that HC-290 was now widely used in the European Union, where safety issues had been adequately addressed, and notable progress had also been made in using hydrocarbons as a low-GWP alternative in a number of Article 5 parties. The uptake of hydrocarbon refrigerants still faced barriers, however, such as the reduced charge where stringent safety standards were applied, and uptake of the technology was still not widespread.

26. Mr. Ray Gluckman added that it was interesting that none of the winners of the Global Cooling Prize competition had employed hydrocarbon options. Greater energy efficiency required larger heat exchangers, which, in turn, implied more refrigerants in the system, which was often not possible under current safety standards. The situation might change as confidence in hydrocarbons increased and safety codes adapted accordingly, or further new refrigerants were developed. In the meantime, gases such as HFC-32 constituted an important stepping stone to reducing the use of HFCs and fulfilling the provisions of the Kigali Amendment.

27. In response to questions about the use of hydrofluoroolefins (HFOs) and HC-290 as refrigerants, Mr. Omar Abdelaziz said that answers would be provided in the report of the Refrigeration, Air-Conditioning and Heat Pumps Technical Options Committee, scheduled for publication in 2022. He added that HFOs and HFO mixtures had not yet been fully developed for the applications considered in the scope of the report, namely, self-contained commercial refrigeration equipment and room air conditioning, and R-454B was being considered as an alternative for R-410A in room air conditioning, but accessibility was currently limited.

### **3. Financing change, including the role of the Multilateral Fund**

28. Ms. Rochat responded to a question on models for financing some of the interventions discussed, in particular options and costs related to equipment manufacturing, and how the payback period for energy efficiency interventions could make them successful funding models. She said that, with regard to enabling policies to promote the use of energy-efficient equipment, different financial instruments were available to support the implementation of energy-efficient measures, for example low-interest loans to overcome the higher initial pricing of products. The financial instrument should be tailored to the product and sector.

29. Responding to a question about how the Montreal Protocol could support a green economic recovery (section 1.4 of the report), Ms. Rochat said that the Protocol had the opportunity to help create a regulatory and policy environment so that, with the economic recovery, any new refrigeration, air-conditioning and heat pump equipment purchased was both energy efficient and of low global warming potential.

30. With regard to change agents for national reform, particularly in relation to national energy pricing as a barrier to the introduction of energy-efficient equipment (section 3.4), and the capacity of the Montreal Protocol to play a leading role in such reform, Ms. Rochat said that the Montreal Protocol had in the past worked with other agencies, and had the opportunity to continue doing so in the future. It was important that national ozone units worked in an integrated manner with energy departments within individual countries for maximum synergy.

31. Responding to a question about complementing cooling action plans by means of funding from the Multilateral Fund, Ms. Dreyfus said that the Executive Committee had recently approved guidelines for the preparation of HFC phase-down plans for Article 5 parties, which would provide insight into the funding options available. Cooling action plans had the potential to be customized according to country requirements, as seen in the case studies, and would make an important contribution to HFC phase-down planning.

32. Ms. Rochat responded to a question on how energy-efficient options could be addressed through the Multilateral Fund, and the economic benefits that pertained to increased energy efficiency, both directly to consumers and indirectly due to a decrease in a country's needed electrical generation capacity. She said that there was a burden and a cost associated with using inefficient equipment. The benefits of switching to more energy-efficient equipment in the context of the HFC phase-down still required further quantification through additional modelling to assess the energy savings in different sectors, subsectors and geographical locations. That was essential work for the future.

33. With regard to the cited demonstration project in Saudi Arabia for the conversion of a room air-conditioning manufacturing line from HCFC-22 to HC-290, and the potential for funding for such conversions from the Multilateral Fund, Mr. Abdelaziz said that the project demonstrated the potential for leapfrogging to more energy-efficient alternatives, although the eligibility of such projects for funding under the Montreal Protocol would become more apparent when the Executive Committee had finalized discussions and taken decisions on the matter. More projects needed to be undertaken in different geographical locations to better assess funding requirements.

#### **4. Modelling and data collection**

34. One representative said that the use of prototype or demonstration projects as the basis for the modelling of alternative technologies in countries with high ambient temperatures, as opposed to the use of real production, manufacturing and marketing examples, meant that many countries with high ambient temperatures lacked the data to safely adopt alternative low-GWP technologies such as those using HFC-32, and instead preferred safer, proven technologies using R-410A. Mr. Abdelaziz responded that the case study of conversion of a manufacturing line of split air-conditioning units from HCFC-22 to HFC-290 was a real conversion project, not a prototype, and the costs presented were the real costs of converting the manufacturing line, although differences in compressor costs were still not available. In addition, the promoting low-global-warming-potential refrigerants for air-conditioning sectors in high ambient temperature countries (PRAHA) project in Egypt had successfully shown that alternative refrigerants were capable of operating in high ambient temperatures and were worthy of consideration by parties.

35. Responding to a question on the use of economic indicators in modelling, Mr. Gluckman said that a big unknown was the rate of future growth of a particular technology in a particular country, and efforts should be made to make projections based on low, medium or high technological growth so that the modelling was realistic.

36. Regarding a suggestion that a questionnaire be developed, by the Technology and Economic Assessment Panel or by the Secretariat, for circulation to parties to obtain information on the availability and accessibility of low-GWP, energy-efficient technologies and products in specific regions and countries, Ms. Rochat said that such a questionnaire could be a useful start. However, good modelling was critically dependent on the quality of data inputs; it would therefore be most beneficial to have funded data systems in place that collected data on a regular basis, thereby increasing the robustness of the modelling over time.

#### **5. Focus of report and future reports**

37. In response to a question on the focus of the report on Article 5 parties, Mr. Elassaad said that previous reports had considered the availability of technologies in countries across all continents and regions, while the present report had mainly focused on challenges facing Article 5 parties. The issue of coverage would be taken into consideration again in the future.

38. On the matter of the range of subsectors that might be addressed in future reports of the energy efficiency task force, Mr. Roberto Peixoto said that would depend on various factors, including the consumption of HFCs and energy consumption. Commercial refrigeration units in supermarkets was a subsector that could be considered.

39. Regarding the possible development by the Technology and Economic Assessment Panel of a detailed regional and world model to further assess the integration of energy efficiency and HFC phase-down measures, and the capacity and mandate of the Panel to perform such modelling, Mr. Ashley Woodcock said that there was a wide range of models of different sectors, covered in significant and comprehensive detail, that could be drawn on for such an exercise. The Panel was looking to strengthen its modelling capability and would have the capacity to undertake the development of such a model if given the mandate to do so by the parties.

40. Regarding the scope of the proposed draft framework to catalogue the diverse and extensive information relevant to energy efficiency that had been compiled in the reports of the Technology and Economic Assessment Panel, Mr. Peixoto said that the main aim was to capture the historical breadth of relevant knowledge and experience lodged in the Panel, the Multilateral Fund and other bodies, much of which was not published or easily accessible.

41. Many representatives, including two speaking on behalf of a group of countries, offered general remarks on the task force report and the topic of energy efficiency. All began by warmly thanking the Technical and Economic Assessment Panel, and the task force in particular, for producing and updating the report and preparing the presentation during what had been an especially

challenging period. There was general agreement that considering energy efficiency during the HFC phase-down was important, particularly in the light of the paradox that cooling was increasingly needed due to climate change but was contributing to the problem at the same time.

42. Elements of the report mentioned as valuable included the many case studies and examples of best practice; payback periods for the more energy-efficient technologies; barriers to adoption; safety concerns; emphasis on the importance of proper maintenance and minimum energy performance standards (MEPS); information on the needed institutional arrangements, capacities, capabilities and regulatory environment; and areas for further discussion by parties on how best to promote enhancing energy efficiency when phasing down HFCs. One representative observed that the reports were becoming increasingly focused and useful to the parties overall, and another concurred, saying that the report would help her country prepare its emissions reduction plan.

43. A number of representatives raised concerns about adding energy efficiency to the equation given the difficulties Article 5 parties already faced in phasing down HFCs, and said that the emphasis had to remain on reaching the compliance targets of the Kigali Amendment. Two representatives added that it was important to bear national circumstances in mind. Several representatives questioned the availability of viable technologies for addressing both ozone layer depletion and climate concerns; in that regard, two representatives said that they did not consider HFC-32 to be a low-GWP refrigerant. One representative, noting that Article 5 parties had limited access to appropriate products even when available, suggested ways to address barriers to access, including awareness-raising and MEPS enforcement training; promotion of large-scale programmes to discontinue the use of inefficient refrigeration and air-conditioning equipment; demonstration of ways to increase energy efficiency when adopting low-GWP refrigerants; and service technician training on the safe use of energy-efficient refrigerants.

44. Specifically addressing the task force's suggestion that individual parties consider adopting a "fast mover" status, one representative was supportive of the idea, pointing out that modelling had highlighted the importance of early action in meeting freeze targets and subsequent control steps, but another said that the timetable for the Kigali Amendment was the outcome of years of difficult negotiations and should remain the basis for future action.

45. The issue of financial support was also raised during the discussion. Several representatives called for an assurance that adequate resources would be provided to address the substantial challenges posed by adding energy efficiency to the mix of considerations. Two representatives cautioned that national ozone units were already under substantial pressure, with one specifying that the introduction of energy efficiency considerations entailed a transformational shift away from ozone layer protection toward energy efficiency and more technology-based situations, which would require substantial capacity-building, particularly for very-low-volume-consuming countries. Two other representatives, including one speaking on behalf of a group of countries, expressed support for an approach of co-funding with other institutions supporting energy efficiency. Yet another urged the Executive Committee of the Multilateral Fund to take more substantive action as soon as possible to allow for coordinated support for the HFC phase-down and energy efficiency improvements. She also suggested that funding be made available for additional energy efficiency demonstration projects and data collection. Another representative echoed the call for additional research, particularly in the refrigeration and air-conditioning sector, and added a request for support for the development of MEPS and other energy efficiency policy instruments by Article 5 parties for refrigeration and air-conditioning equipment.

46. In terms of next steps, several representatives, including one speaking on behalf of a group of countries, expressed support for extending the mandate of the task force, including to cover the additional modelling and the further development of a draft framework for information cataloguing proposed in the task force report. Other areas for further work were also proposed, including the identification of sectors offering potential for immediate or early action, taking in consideration factors such as cost, technology access, ease of implementation and availability of funding, as well as the environmental benefits and potential financial benefits of such action; broader coverage of the types of equipment involved, particularly to include heat pumps; further information on certification programmes in the refrigeration, air-conditioning and heat pumps sector; the refining of existing models to make them more accurate and tailored to specific conditions; better integration of economic and development elements into the models; investigation of the relationship between refrigerant type and equipment energy efficiency in the modelling, along with any potential trade-offs; additional information on costs and opportunities for "equipment receivers" and end-user sectors; additional information to support the development of cooling action plans; and the effect of humidity on natural refrigerants, particularly hydrocarbon.

47. Several representatives, including two speaking on behalf of a group of countries, said that they looked forward to further discussions on the matter in the near future. One representative indicated that his country was preparing a conference room paper for submission to the Thirty-Third Meeting of the Parties and invited parties to contribute to intersessional work on a mandate for the energy efficiency task force.

48. Another representative said that his country intended to introduce a conference room paper focused on the harmful dumping of new and used inefficient refrigeration and air-conditioning appliances at the Thirty-Third Meeting of the Parties. The draft decision, submitted in coordination with other parties on behalf of the African States, would be in line with decision 17/1 of the African Ministerial Conference on the Environment, in which the Conference urged parties to the Montreal Protocol to adopt an action plan preventing market penetration of obsolete equipment in Africa while facilitating access to secure and energy efficient technologies on the continent.

#### **IV. Closure of the meeting**

49. Following the customary exchange of courtesies, the forty-third meeting of the Open-ended Working Group was adjourned and the online technical session on energy efficiency was declared closed at 6.25 p.m. on Saturday, 17 July 2021.



## Annex

### **Presentation by the decision XXX/5 task force (energy efficiency task force) of the Technology and Economic Assessment Panel at the online session on energy efficiency of the forty-third meeting of the Open-ended Working Group, held on 16 and 17 July 2021\***

#### **Introduction**

1. Ms Helene Rochat opened the presentation by emphasizing how the climate emergency is the defining issue of our time. She noted text for Decision XXXI/7: “To request the Technology and Economic Assessment Panel to prepare a report for consideration by the Thirty-Second Meeting of the Parties addressing any new developments with respect to best practices, availability, accessibility and cost of energy-efficient technologies in the refrigeration, air-conditioning and heat-pump sectors as regards the implementation of the Kigali Amendment to the Montreal Protocol”.

2. Ms Rochat introduced the members of the Energy Efficiency Task Force (EETF), and noted that out of 26 members and 2 consulting experts, 16 are from Article 5 Parties. She stated that the focus of this report is on room air conditioners and self-contained commercial refrigeration equipment (SCCRE). She then gave an overview of the previous TEAP reports on energy efficiency and presented their main messages as follows. Cooling is necessary but it is creating a vicious circle with increasing demand driving both direct and indirect CO<sub>2</sub> emissions. Energy efficient equipment with lower GWP refrigerants is now available and increasingly accessible. It is possible to leapfrog directly from HCFCs to lower GWP refrigerants in higher energy efficient equipment in many sectors and regions. Parties that have established MEPS without considering the HFC phasedown, still have a continued use of high GWP refrigerants. Equipment-receiving Article 5 parties with no or low MEPS only have access to low EE/ high GWP imported RACHP equipment. The excess power demand will lead to a substantial long-term economic disadvantage. Synergies with Energy Efficiency during the HFC phase-down could double the climate benefit.

3. She went on to describe some of the many developments in cooling, HFCs and energy efficiency. It is becoming clear, especially in hot countries, that burning fossil fuels to meet the cooling demand is unsustainable, and decarbonizing power generation, with improving energy efficiency through stronger regulations, alongside HFC phasedown are critically important.

4. Many Article 5 parties without Minimum energy performance standards are vulnerable to the dumping of low EE/high GWP Room ACs with a long-term burden for energy generation. It is estimated that the adoption of the best technologies could reduce climate emissions in the range of 130-260 Gt CO<sub>2</sub>eq from 2030 to 2050. This would avoid 3 trillion dollars in energy and operating costs by 2050 and reduce energy needs by 20%.

#### **Chapter 2**

5. Mr Omar Abdelaziz provided a technical update on lower GWP refrigerants with energy efficiency technologies. He described the improving energy efficiency of equipment, with recent advances including the use of sensors and controls to optimize performance and minimize energy consumption, the proliferation of cost-effective variable speed drives, and the implementation of condenser precooling. Several conversion projects had successfully demonstrated the possibility to leapfrog from HCFCs to lower GWP technologies while maintaining or enhancing EE. Leapfrogging could enable the industry to explore synergies between refrigerant conversion and energy efficiency with lower retooling. Mr Abdelaziz stated that the Montreal Protocol family has a unique in-depth knowledge of RACHP that can successfully implement conversion projects to simultaneously reduce direct and indirect emissions. The report also presented typical incremental capital and operating cost for conversion to lower GWP and energy efficient technologies showing that most of the investment is required to accommodate the safety requirements to handle flammable lower GWP refrigerants.

6. Mr Abdelaziz then moved to describe the safety barriers for EE improvement using lower GWP refrigerants which were presented in the report. It found that the wide adoption of lower GWP flammable refrigerants in self-contained refrigeration equipment (SCCRE). However, safety concerns are still impeding the wide scale adoption of lower GWP refrigerants in room AC. In room AC, these

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\* The annex has not been formally edited.

barriers include: Lack of harmonization between the different standards bodies, lack of strong regulatory and market signals, charge limits on flammable refrigerant that constrain EE improvements, higher equipment cost, the need to develop the skills of technicians for safe installation and servicing of A3 and A2 refrigerants, compared to A1 and A2L refrigerants, and the need for implementation of “Worldwide Technician Certification Schemes” to reduce leakage and improve safety.

7. Finally, Mr Abdelaziz commented on the technical barriers to transition into lower GWP refrigerant and higher EE for room AC. These include reliability of microchannel Heat Exchangers in coastal and polluted areas, difficulty with on-site repair, lack of trained welders, and challenges with condensate removal and defrosting. There is a balance to be struck, with larger airflow rates improve Energy Efficiency at the cost of reduced comfort and increased noise. Also with larger heat exchange surfaces which improve Energy efficiency, but at the cost of larger equipment sizes which in practice limit installation.

### Chapter 3

8. Mr Bassam Elassaad presented an overview availability and accessibility to high energy efficiency technologies using lower-GWP He showed the availability of both products and components across all regions for both room AC and SCCRE. He stated there was limited accessibility, although improving, in many Article 5 countries and even in some non-Article 5 countries.

9. Mr. Elassaad pointed out that the report looked at availability from an Article 5 local manufacturing point of view and concluded that the absorption and application of lower-GWP, high energy efficiency technologies is related to the level of consumption; the higher the level, the more advanced the technology. Irrespective of size, manufacturers need to build their technical capabilities to absorb and apply new technologies. The best-in-class available technologies are two times better than the average units sold on the market and can be on average up to 2.5 better than the lowest efficiency units being sold. As volumes increase, the cost of more efficient equipment is decreasing even as energy efficiency standards are increasing.

10. On accessibility, which was considered from an end user point of view, Mr. Elassaad pointed out that several factors affect accessibility such as regulatory environment including MEPS and labelling programmes, affordability by consumers which is impacted by the payback period and programmes providing cooling as a service, and the existence of service expertise. Barriers to accessibility still exist, but can be removed through increased awareness, training, enforcement, and support for technology transfer.

11. Mr. Elassaad concluded that it is in the national interest to reduce electricity demand. In many A5 parties there is already a shortage of electricity generating capacity and will get worse with the growth in air conditioning and refrigeration. Funding the reduction of demand is more effective than funding new power plants.

### Chapter 4

12. Ms. Gabrielle Dreyfus presented key messages from 27 case studies that were compiled by the EETF taking into consideration diversity of geography, policy type, and equipment type. She noted that the diversity of the membership of the task force enabled the collection of these case studies. The key messages included: the importance of coordination between energy efficiency officials and ozone officers to facilitate the transition to lower GWP and higher EE equipment, with less desirable outcomes observed when this is not the case; how individual parties are—and could—further benefit from pairing leapfrogging to low-GWP alternatives with progressive efficiency improvement; how waiting and allowing inefficient and high-GWP cooling equipment to become a large stock results in higher energy demands and costs with associated economic burdens that could last decades due to the long lifetimes of cooling equipment; and how developing and enforcing policies and regulations to avoid this build-up of low-efficiency equipment could limit the economic disadvantage from environmentally harmful dumping.

13. She highlighted three case study examples, including the Global Cooling Prize; and two policies that integrate energy performance and GWP thresholds, including new standards and labelling policies in Brazil and model regulations developed by United for Efficiency. She noted that such integrated policies help inform consumers and can be used for specifications for procurement and incentive programs.

## Chapter 5

14. Mr Ray Gluckman presented a significant addition to the 2020 EETF report, based on recent developments in modelling of gas and energy use in the refrigeration, air-conditioning and heat pump market. He explained that having good modelling tools available helps inform policy development. At country level modelling will help with the development of HFC Phase-down Plans. For TEAP and other Montreal Protocol bodies, good modelling improves the information that can be presented to Parties. Examples of the insights from modelling include: (a) a better understanding of complex markets, (b) comparisons of different HFC phase-down trajectories, (c) assessment of actions that reduce HFC and energy consumption and emissions and (d) understanding the potential to improve EE in combination with HFC phase-down.

15. He stressed that it is important to ensure that modelling is realistic – models that are too simplistic or that use incorrect input assumptions can provide very misleading outputs. Some useful “rules” of good HFC phase-down and energy modelling were presented. A number of outputs from the HFC Outlook + Energy model were presented. This modelling platform has been developed with support from UNEP and models have been created for 10 Article 5 countries. The outputs presented included an analysis of HFC phase-down trajectories, a comparison of direct refrigerant emissions and indirect energy related emissions and an evaluation of how cuts in both direct and indirect GHG emissions can be achieved. The potential benefit of using heat pumps to decarbonise space and process heating was also presented.

16. Some key messages that were presented by Ray Gluckman include: (1) energy related emissions are about 70% of the total GHG emissions from RACHP – it is important these are not neglected, (2) there is excellent potential to simultaneously reduce both refrigerant and energy related emissions, (3) early action can halve the cumulative emissions between now and 2050 compared to a “Just Compliant” HFC phase-down scenario, (4) use of heat pumps can create large reductions in fossil fuel emissions and (5) good models help planning the best phase-down policies.

## Chapter 6

17. Mr Roberto Peixoto presented a draft framework proposal to catalogue outputs from previous TEAP and EETF Reports. He stated that the main objective of this proposed framework is to assist the understanding of the Parties, considering the options related to capacity building, service sector, manufacturing (which includes assembly of products and units and component manufacturing) and “not-in-kind” alternatives. Mr. Peixoto pointed out that the framework would enable parties access to the best data to optimize their actions, as they move forward to operationalise the Kigali Amendment. In describing the reasons for the draft framework proposal, Mr. Peixoto commented that TEAP Energy efficiency task forces have compiled and reported a large amount of diverse and extensive information on refrigerant and technology options, costs, availability, accessibility, best practices, and relevant funding agencies. He emphasized that it was developed considering maintaining or enhancing energy efficiency in the refrigeration, air-conditioning and heat pump sector while phasing down HFCs under the Kigali Amendment.

18. Mr Peixoto then moved to describe the funding issue. He mentioned that in the EETF 2018 report, and the EETF reports in response to Decision XXX/5 and Decision XXXI/7, the EETF has reviewed and presented information on funding institutions related to climate protection and energy efficiency, while phasing down HFCs in the RACHP sector. He said that those reviews and other studies clearly show that the structure of those funding mechanisms and procedures is largely influenced by the scale of the funding portfolio. In general, the climate funding options are designed for large scale and large funding programs, which creates a barrier for individual small-scale MP projects, mainly from low volume consuming Parties. Assessing and estimating the scale and scope of a funding portfolio and project pipeline could identify the best options for co-financing and drive the needed arrangements. Finally, Mr. Peixoto stated that the main message from the draft framework proposal is that the MP community, Parties, TEAP, MLF and Implementing Agencies, have the unique ability to estimate the potential conversions, supporting policies and enabling activities that would be involved in a synchronized and successful transition to low-GWP alternatives while maintaining or enhancing EE.

## Conclusion

19. Mr Ashley Woodcock (EETF Co-chair) provided some context for the Energy Efficiency Task Force Report. He indicated that the parties initially took Decision XXXI/7 on Energy Efficiency in Rome in Nov 2019. However, no party discussions were able to take place in 2020, and as a result, parties will be discussing Energy Efficiency virtually in July and October 2021. As a result, it is possible that the first face-to-face discussions could be delayed until July 2022 at the OEWG, two and a half years since Decision XXXI/7 was taken.

20. Meanwhile, he indicated that technology and market developments are continuing. Accessibility to RACHP equipment is improving, and we have a better understanding of the synergy between HFC phasedown and energy efficiency. And as the world economy recovers after the pandemic, there is an opportunity for a “green” recovery.

21. In spite of these challenges, he stated that over the past 18 months the EETF has maintained momentum, providing an update report for this July 2021 OEWG, containing additional policy-relevant information, and important new modelling.

22. Mr Woodcock identified a number of near-term questions for the consideration of Parties, all of which were contained within the Executive Summary. These included:

- How to facilitate the collaboration between Ozone and Energy Departments?
- How to encourage the implementation of integrated regulations for Energy Efficiency during HFC phasedown?
- How to improve the accessibility to lower GWP/high EE RACHP equipment?
- How to prevent dumping of high GWP/low EE RACHP equipment into technology receiving A5 parties to avoid substantial long-term disadvantages?
- How to overcome the remaining barriers on patents for the use of high-EE and low-GWP technologies, which is an issue for some SMEs in A5 parties?
- How to assist parties who wish to adopt a “fast mover” status with synergistic HCFC phase-out and HFC phase-down with progressive improvement in energy efficiency?

23. Mr Woodcock indicated that, if requested, TEAP and its Energy efficiency Task Force had the capacity to carry out future work. This could include an expansion of the work on modelling to assess the benefits of the integration of energy efficiency and HFC phase-down measures on a regional and global basis. It could further develop the framework to catalogue the information from five TEAP/EETF reports, and from other sources including the Multilateral Fund and Implementing Agencies, in order to assist parties as they move forward to operationalise the Kigali Amendment. Finally, it could evaluate scenarios to curb the growth of high GWP HFCs, while integrating energy efficiency.

24. Mr Woodcock concluded by asking how the Montreal Protocol can meet the Kigali Challenge in a timely manner? Demand for cooling is increasing rapidly, and time is getting short, with a real risk of inaction secondary to delays through the COVID pandemic. He reminded parties that the Montreal Protocol has already recognised the need to improve the energy efficiency of RACHP equipment during the phase-down of high GWP refrigerants. And that as efficient cooling gains traction at COP-26, there will be substantial interest in the synergies between EE and the HFC phase-down under the Montreal Protocol. He re-iterated that the in-depth knowledge of the RACHP sector held within the “Montreal Protocol family” means that it is uniquely placed to enable a combined reduction of both direct and indirect GHG emissions.

25. Mr Woodcock thanked his outstanding co-chairs Helene Rochat and Roberto Peixoto, all the Task Force members, but especially the chapter lead authors Omar Abdelaziz, Bassam Elassaad, Gabrielle Dreyfus and Ray Gluckman, and the TEAP for their review and helpful comments on the EETF report and presentation.