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Open-ended Working Group of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer
Fortieth meeting
Vienna, 11–14 July 2018

Report of the fortieth meeting of the Open-ended Working Group of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer

I. Opening of the meeting

1. The fortieth meeting of the Open-ended Working Group of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer was held at the Vienna International Centre, Vienna, from 11 to 14 July 2018. The meeting was co-chaired by Mr. Yaqoub Almatouq (Kuwait) and Ms. Cynthia Newberg (United States of America).

2. The meeting was opened at 10.05 a.m. on Wednesday, 11 July 2018, by Mr. Almatouq. Opening statements were delivered by Mr. Josef Plank, Secretary General of the Austrian Federal Ministry of Sustainability and Tourism, and Ms. Tina Birmpili, Executive Secretary of the Ozone Secretariat.

3. Welcoming participants to Vienna, Mr. Plank recalled that the Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol had been instrumental in the near-complete phase-out of ozone-depleting substances and the consequent recovery of the ozone layer, and had also resulted in a reduction in greenhouse gas emissions. The adoption of the Kigali Amendment to the Protocol demonstrated a commitment to remaining on track by phasing down hydrofluorocarbons (HFCs), which could help avoid up to 0.5°C of global warming by the end of the century, thereby contributing to the achievement of the objectives of the Paris Agreement on climate change.

4. Further progress risked being undermined, however, by a recently reported increase in global emissions of the chlorofluorocarbon CFC-11, which, although it proved the efficacy of the Montreal Protocol implementation and surveillance tools, was a matter of great concern, and he called for swift, appropriate action in that regard. Such action, he said, might have the added benefit of encouraging a redoubling of efforts and providing an opportunity to refine the Protocol implementation strategies and render them even more effective for the implementation of the Kigali Amendment.

5. Highlighting the strengths of the Montreal Protocol, he said that the Kigali Amendment thereto represented an opportunity for the international community to adopt new ozone- and climate-friendly technologies that would improve energy efficiency, employment and, hence, efforts to build a sustainable economy, which was a major challenge for every country in the world. Of crucial importance to the success of the Montreal Protocol were its multilateral, science-based nature and the legally binding limits it set on the production and consumption of ozone-depleting substances. Another lesson learned from its implementation was the fact that, ultimately, Governments and industry were ready to adapt. It was equally important, he said, to create compliance incentives for less developed countries and a sense of common commitment and equity. The current meeting would enable parties to

start the process of implementing the Kigali Amendment and to contribute to the ozone layer's continued recovery, to climate mitigation and to the implementation of the Paris Agreement on the ground. He wished the Working Group every success in its deliberations.

6. Ms. Birmpili, in her statement, said that it was important to keep in mind the significant contributions that the ozone treaties and decisions under those treaties were making to the achievement of 13 out of the 17 Sustainable Development Goals of the 2030 Agenda for Sustainable Development. Those contributions should increase with the implementation of the Kigali Amendment from 1 January 2019, and she thanked the 39 parties that had thus far ratified the Amendment for their leadership and the example that they had set for future efforts to ensure universal ratification. To that end, the proposed forms for reporting data under Article 7 of the Montreal Protocol, which had been discussed at the Twenty-Ninth Meeting of the Parties to the Montreal Protocol and subsequently revised by the Secretariat, would hopefully provide a sound basis for the Working Group's discussions on the matter at the current meeting.

7. Among the other key items on the meeting's agenda, she drew attention to the many reports produced by the Technology and Economic Assessment Panel, whose 2018 report included an assessment of destruction technologies for controlled substances, the nominations for exemptions for methyl bromide use in agriculture and possible requirements for hydrochlorofluorocarbons (HCFCs) after the phase-out period for parties not operating under paragraph 1 of Article 5 of the Montreal Protocol (non-Article 5 parties). The Panel would also provide information on the availability of halons and their alternatives, on the laboratory and analytical uses no longer requiring the use of ozone-depleting substances, and on process-agent applications. She urged all parties to support the Panel in its efforts to renew its thinking, expertise and composition – which should also be more balanced in terms of gender – so as to ensure the provision of expert review and advice to tackle newly emerging substantive technical and scientific issues.

8. Meanwhile, the Working Group would continue the discussion started at the Twenty-Ninth Meeting of the Parties on the linkages between HCFCs and HFCs in the transition to low-global-warming-potential alternatives. The Technology and Economic Assessment Panel report prepared in response to decision XXIX/10 and feedback from the energy efficiency workshop held immediately prior to the present meeting should enable the Working Group to gain greater insight into the growing need for access to cooling through energy efficiency opportunities in the refrigeration and air-conditioning sector. That access was crucial for the attainment of several targets of the Sustainable Development Goals, especially those concerning zero hunger, ending poverty, economic growth and sustainable cities, as well as global food waste and the need to feed an increasing global population. She added that the Kigali Amendment had been instrumental in placing the linkages between cooling, energy efficiency and climate change higher on the international agenda. The Working Group would also consider two proposals for adjustments to the Montreal Protocol. The first, submitted by the United States of America, sought to add fire suppression to the existing servicing tail for HCFCs for the period 2020–2030; the second, submitted by Australia and Canada, focused on permitting essential-use exemptions of HCFCs as was the case for other controlled substances. She also pointed out that the seventh replenishment of the Global Environment Facility, approved at the fifty-fourth meeting of the Global Environment Facility Council, included funding to assist countries with economies in transition in phasing down the production and consumption of HFCs and continued funding for the phase-out of HCFCs.

9. She then drew attention to the alarming issue of the recently reported unexpected increase in global emissions of CFC-11, the second most abundant ozone-depleting gas controlled by the Montreal Protocol. Calling on Governments, industry, civil society, implementing agencies and the institutions of the Montreal Protocol to act collectively and decisively to take stock of the available science, to identify and to address the causes of the increase, she warned that a failure to do so risked jeopardizing the continued recovery of the ozone layer. The parties had an obligation to use the institutions of the regime that they had created and could not relax their vigilance even for a second. She urged all the parties and stakeholders to ensure that the issue did not go unaddressed.

10. While the scientific findings on the issue underscored the efficacy of the Protocol, its institutions and mechanisms, with science at their core, it was important to ensure that the research community had the means to sustain its vigilance in monitoring ozone-depleting substances in the atmosphere – including by avoiding the closure of measurement stations due to lack of funding – and to conduct further scientific studies and share the information. Attention must therefore be paid to the matter of whether and how to further strengthen those mechanisms so as to ensure adherence to the Protocol and prevent any future illegal consumption and/or production of CFC-11 and other harmful substances. The projected future benefits of the Montreal Protocol as a whole were at stake. The Montreal Protocol had a reputation as one of the most successful multilateral environmental

agreements in history; its standing among the multilateral environmental agreements must not be tarnished nor the trust in its institutions and mechanisms dampened.

11. In closing, she thanked the European Union for the resources it had contributed towards the publication of an updated hard-copy edition of the Montreal Protocol handbook that would be distributed at the current meeting, and she offered her sincere condolences to the family of the recently deceased former coordinator of the National Ozone Unit of Tajikistan, Mr. Kurbanov Abdukarim Kurbanovich.

II. Organizational matters

A. Attendance

12. The following parties to the Montreal Protocol were represented: Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Barbados, Belarus, Belgium, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Canada, Chad, Chile, China, Colombia, Comoros, Cook Islands, Costa Rica, Croatia, Cuba, Cyprus, Czechia, Democratic People's Republic of Korea, Djibouti, Dominican Republic, Ecuador, Egypt, El Salvador, Eswatini, European Union, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Grenada, Guatemala, Guinea Bissau, Haiti, Honduras, Hungary, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Italy, Japan, Jordan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Lao People's Democratic Republic, Lebanon, Lesotho, Libya, Lithuania, Madagascar, Malawi, Malaysia, Maldives, Mali, Marshall Islands, Mexico, Micronesia (Federated States of), Mongolia, Montenegro, Morocco, Mozambique, Namibia, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Republic of Korea, Qatar, Romania, Russian Federation, Rwanda, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saint Vincent and the Grenadines, Saudi Arabia, Senegal, Seychelles, Slovakia, South Africa, South Sudan, Spain, Sri Lanka, Sweden, Switzerland, Syrian Arab Republic, Thailand, The former Yugoslav Republic of Macedonia, Togo, Tunisia, Turkey, Turkmenistan, Tuvalu, Uganda, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, United States of America, Uruguay, Vanuatu, Venezuela (Bolivarian Republic of), Viet Nam, Zimbabwe.

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

14. The following intergovernmental, non-governmental and industry bodies and organizations were represented as observers: AGC Chemicals, Alliance for Responsible Atmospheric Policy, Blue Star Ltd., Building Efficiency, China Household Electrical Appliances Association (CHEAA), China National Institute of Standardization, Cool Concerns, Ltd., Daikin, Daikin Industries, Ltd., Danfoss A/S (Denmark), Delhaize, Emergent Ventures India, Energy Efficiency Services, Ltd., ESCO Committee of China Energy Conservation Association, European Investment Bank Group, European Partnership for Energy and the Environment (EPEE), EPEE/Mitsubishi Electric Europe , Gujarat Fluorochemicals, Ltd., HEAT International, HVAC/R Knowledge Centre CAREL Industries, ICF International, Industrias Thermo-Tar, Ltd., Institute of Building Research and Innovation, International Pharmaceutical Aerosol Consortium, Japan Fluoricarbon Manufacture Association, Japan Refrigeration and Air-Conditioning Industry Association, MEBROM, Mexichem UK, Ltd., Midea Group, , NIDEC, Nolan Sherry and Associates, Ltd., Quimobásicos SA de CV, Refrigerant Gas Manufacturers Association, Refrigerant Reclaim Australia, Refrigerants Australia, Refrigeration and Air-Conditioning Manufacturers Association of India, Shecco, SRS Licensing Pty, Ltd., The Chemours Company, Trans-Mond Environment, Ltd., United Technologies Climate, Controls and Security, United Technologies Corporation, United Technologies Corporation Carrier, University of São Paulo, Victorian Strawberry Industry Certification Authority.

B. Adoption of the agenda

15. The Working Group adopted the following agenda on the basis of the provisional agenda set out in document UNEP/OzL.Pro.WG.1/40/1/Rev.1:

1. Opening of the meeting.
2. Organizational matters:

(a) Adoption of the agenda;

(b) Organization of work.

3. Kigali Amendment to the Montreal Protocol to phase down hydrofluorocarbons:

(a) Data reporting under Article 7 and related issues;

(b) Destruction technologies for controlled substances (decision XXIX/4).

4. Technology and Economic Assessment Panel 2018 report, including issues relating to:

(a) Nominations for critical-use exemptions for methyl bromide for 2019 and 2020;

(b) Progress in the implementation of decision XXIX/8 on future availability of halons and their alternatives;

(c) Development and availability of laboratory and analytical procedures that can be performed without using controlled substances under the Protocol (decision XXVI/5);

(d) Process agents (decision XVII/6);

(e) Organizational and other matters.

5. Linkages between hydrochlorofluorocarbons and hydrofluorocarbons in transitioning to low-global-warming-potential alternatives (UNEP/OzL.Conv.11/7–UNEP/OzL.Pro.29/8, para. 162).

6. Issues related to energy efficiency while phasing down hydrofluorocarbons (decision XXIX/10):

(a) Report by the Technology and Economic Assessment Panel on energy efficiency in the refrigeration, air-conditioning and heat pump sectors;

(b) Outcome of the workshop on energy efficiency opportunities while phasing down hydrofluorocarbons.

7. Requirements for hydrochlorofluorocarbons for the period from 2020 to 2030 for parties not operating under paragraph 1 of Article 5 of the Protocol (decision XXIX/9):

(a) Report by the Technology and Economic Assessment Panel on hydrochlorofluorocarbons and decision XXVII/5;

(b) Proposed adjustments to the Montreal Protocol.

8. Consideration of senior expert nominations from parties to the Technology and Economic Assessment Panel (decision XXIX/20).

9. Other matters.

10. Adoption of the report.

11. Closure of the meeting.

16. The Working Group agreed to consider the following three proposals under agenda item 9, "other matters": a discussion, proposed by the representative of the European Union, on global emissions of CFC-11; a review, proposed by the representative of Saudi Arabia, of the composition and organization of the assessment panels, including their terms of reference, in the light of the impending implementation of the Kigali Amendment; and a discussion, proposed by the representative of the United Arab Emirates, of that party's eligibility for financial and technical assistance from the Multilateral Fund for the Implementation of the Montreal Protocol. In the discussion on the third proposal, one party suggested that the issue of eligibility for financial and technical assistance might affect other parties and should be discussed with a broader perspective.

C. Organization of work

17. The Working Group agreed to the organization of work, which deviated from the order of the provisional agenda in order to make the best use of the time available. In so doing the Working Group agreed to the proposal by the Co-Chair on the timing of discussions on the three items added under agenda item 9. Agenda item 9 (a) concerning the global emissions of CFC-11, based on the request by one party that it be taken up early in the agenda, would be considered after agenda item 7 on the requirements of HCFCs for 2020 to 2030 for non-Article 5 parties, including the proposed adjustments to the Montreal Protocol. Agenda item 9 (b) on the composition and organization of the Technology

and Economic Assessment Panel would be discussed as a separate agenda item after the sub-item 4 (e) (organizational and other matters) and agenda item 8 (consideration of senior expert nominations under the Technology and Economic Assessment Panel) to allow for a comprehensive discussion related to the assessment panel. Agenda item 9 (c), the item on eligibility for technical and financial assistance, added at the request of the United Arab Emirates, would also be considered thereafter.

18. The Working Group agreed to establish contact and informal groups and to hold night sessions as necessary to finalize its work; to avoid holding contact group meetings in parallel with each other or with plenary meetings; and to avoid, to the extent possible, the holding of simultaneous informal group meetings. Morning sessions would run from 10 a.m. to 1 p.m. and afternoon sessions from 3 to 6 p.m.

III. Kigali Amendment to the Montreal Protocol to phase down hydrofluorocarbons

A. Data reporting under Article 7 and related issues

19. Introducing the sub-item, the Co-Chair drew attention to the note by the Secretariat on data reporting under Article 7 of the Montreal Protocol, including related issues arising from the Kigali Amendment to phase down HFCs (UNEP/OzL.Pro.WG.1/40/3). The note provided comprehensive information on the three remaining issues that the Twenty-Ninth Meeting of the Parties had determined were in need of further consideration at the present meeting, namely the timeline for the reporting of baseline data for HFCs by Article 5 parties; the global-warming-potential values for HCFC-141 and HCFC-142; and the revised data reporting forms and associated instructions, including the reporting of HFC mixtures and blends, the latest versions of which were also presented in the note by the Secretariat. She suggested that the issues should be discussed in a contact group.

20. In the ensuing discussion, general appreciation was expressed for the information provided and for the proposal to discuss the remaining issues in a contact group. One representative said that her country had conducted studies of HFCs and HFC-23 and would be able to begin tracking them in 2019.

21. The Working Group agreed to establish a contact group, co-chaired by Mr. Martin Sirois (Canada) and Mr. Zhifeng Zhong (China), to further consider the issues of the timeline for the reporting of baseline data for HFCs by Article 5 parties; the global-warming-potential values for HCFC-141 and HCFC-142; and the revised data reporting forms and associated instructions, including the reporting of HFC mixtures and blends.

22. The co-chair of the contact group, reporting on progress achieved by the group, said that it had agreed to instruct the Ozone Secretariat to use the global warming potential (GWP) values of HCFC-141b and HCFC-142b for HCFC-141 and HCFC-142, respectively, when calculating the HFC baselines of affected parties, given the fact that HCFC-141b and HCFC-142b represented the most commercially viable isomers of those substances. In order to support that approach, the group had noted that the anomalies leading to the reporting and recording of HCFC-141 and HCFC-142 for 1989 data were due to the limitations of the reporting forms available at the time that did not allow the reporting of the most commercially viable isomers of those substances. The group had also agreed that the parties affected would not request changes to their past HCFC baselines, but instead the quantities reported as HCFC-141 and HCFC-142 would be considered as HCFC-141b and HCFC-142b, respectively, for the purpose of calculating HFC baselines.

23. Subsequently, the co-chair of the contact group reported on the further progress made by the group. The group had agreed that Article 5 parties should report real rather than estimated baseline data for HFCs. However, when that data was not available, language such as “deferral of non-compliance” should be avoided, as that could imply that the party concerned was not in compliance with its obligations under the Kigali Amendment; the group agreed to try to find a different way forward, and interested parties would provide text which could be posted on the contact group’s page on the meeting portal to allow for further discussion at the Thirtieth Meeting of the Parties.

24. With respect to the errors included in the Kigali Amendment for the global warming potentials of HFC-123 and HFC-124, the group had agreed that the issue would best be addressed through a decision of the Meeting of the Parties, and that interested parties would aim to draft appropriate text. With respect to data reporting of HFC-23 emissions, the group had agreed that the reporting forms should not be restricted only to emissions but should include other information; the Secretariat had already provided on the meeting portal a revised version of the relevant data reporting form (form 6).

Interested parties were invited to submit comments to the Secretariat on the form, which, it was to be hoped, could be adopted by a decision of the Meeting of the Parties.

25. The Working Group agreed with the proposed approach on the GWP values for HCFC-141 and HCFC-142 and also agreed to defer further consideration of the outstanding issues to the Thirtieth Meeting of the Parties.

B. Destruction technologies for controlled substances (decision XXIX/4)

26. Introducing the sub-item, the Co-Chair drew attention to the background information set out in paragraphs 8 to 15 of document UNEP/OzL.Pro.WG.1/40/2 and paragraphs 4 to 7 of, and annexes I and II to, the addendum thereto (UNEP/OzL.Pro.WG.1/40/2/Add.1). He recalled that, by its decision XXIX/4, on destruction technologies for controlled substances, the Twenty-Ninth Meeting of the Parties had requested the Technology and Economic Assessment Panel to report by 31 March 2018, and if necessary to submit a supplemental report to the Open-ended Working Group at its current meeting, on (a) an assessment of the destruction technologies as specified in the annex to decision XXIII/12 with a view to confirming their applicability to HFCs; and (b) a review of any other technology for possible inclusion in the list of approved destruction technologies in relation to controlled substances. In decision XXIX/4, the parties had also been invited to submit to the Secretariat, by 1 February 2018, information relevant to the Panel's work under the decision.

27. Pursuant to decision XXIX/4, in April 2018 the Panel had issued its report on destruction technologies for controlled substances as volume 2 of its 2018 report and, on the basis of additional information obtained thereafter, it had issued a supplemental report on destruction technologies in May 2018. The Panel's final recommendations were contained in its supplemental report and were reproduced in annexes I and II to document UNEP/OzL.Pro.WG.1/40/2/Add.1. The comments initially received from parties had been considered by the Panel and had also been compiled in a separate document which was available on the meeting portal.

28. Ms. Helen Tope and Ms. Helen Walter-Terrinoni, co-chairs of the decision XXIX/4 task force of the Technology and Economic Assessment Panel, presented the key features related to destruction technologies for controlled substances of the report and the supplemental report. A summary of the presentation, prepared by the co-chairs of the task force, is set out in section A of annex II to the present report.

29. In the ensuing discussion, representatives expressed appreciation to the Technology and Economic Assessment Panel and its decision XXIX/4 task force for their hard work and for the reports and information provided. Responding to questions, the task force co-chair said that the Panel had used an objective approach, requesting information from parties and technology owners and assessing such information against the same technical performance criteria used to assess destruction technologies for ozone-depleting substances that had been developed by the Panel in 2002. She explained that the Panel had examined the issue of HFC blends and was of the view that technologies serving to destroy or convert HFCs also applied to HFC blends.

30. Regarding a question on the potential use of cement kilns to destroy HFCs in a cost-effective manner in Article 5 parties, the task force co-chair responded that, owing to a lack of data, the Panel had not been able to properly assess the technology or recommend it for possible inclusion on the list of approved destruction technologies, but had nevertheless identified it as a technology with high potential to destroy HFCs. Two representatives suggested that cement kilns and other technologies classified as being of such high potential should in principle be listed as approved destruction technologies, given that the Panel had found that those technologies had been shown to destroy ozone-depleting substances in accordance with the technical performance criteria on at least a pilot or a demonstration scale and should therefore be considered capable of destroying HFCs.

31. Noting that plasma arc technology consumed high levels of electricity but had nevertheless been recommended for listing as an approved technology by the Panel, one representative asked whether the Panel had assessed the energy efficiency and greenhouse gas emissions of the various technologies examined. The task force co-chair responded that the Panel had not looked at such parameters, which went beyond its mandate under decision XXIX/4. The representative subsequently suggested that there was a need to discuss the possible expansion of the Panel's mandate to include greenhouse gas emissions and energy efficiency as criteria against which destruction technologies should be assessed.

32. Several representatives, including one speaking on behalf of a group of parties, suggested that, while the 2002 technical performance criteria used by the Panel to assess destruction technologies, such as emissions of particulates and carbon monoxide, could help the parties to regulate specific technologies at the national and subnational levels, destruction and removal efficiency was the most

important criterion against which destruction technologies should be assessed. One of the representatives suggested that criteria other than destruction and removal efficiency should not be used to determine whether a given technology should be listed as an approved destruction technology under the Montreal Protocol.

33. Several representatives expressed support for the provision of additional information by the parties on some of the technologies for which data were lacking in the lead-up to the Thirtieth Meeting of the Parties in order to enable the Panel to review such information prior to the meeting.

34. One representative expressed support for the approach used by the Panel to assess destruction technologies for methyl bromide, given that the destruction of methyl bromide was different to that of other ozone-depleting substances.

35. Many representatives said that the issue of destruction was of great importance to Article 5 parties and underscored the need to discuss the issue in more detail, including the costs of different destruction technologies and the creation of a mechanism to support the destruction and management of HFC stockpiles in Article 5 parties.

36. Following the discussion, the Working Group agreed to establish a contact group, to be co-chaired by Ms. Bitul Zulhasni (Indonesia) and Mr. Ralph Brieskorn (Netherlands), to discuss the Panel's findings and recommendations and to consider possible further work related to destruction technologies to be undertaken by the Panel.

37. The co-chair of the contact group, reporting on the progress achieved by the group, said that it had considered a revised table of destruction technologies, focusing on the technologies with high potential for approval. Several parties were of the view that destruction and removal efficiency should be the key element in determining the technologies to be approved by parties for the destruction of HFCs in order to have agreement by the parties before the entry into force of the Kigali Amendment, while other emissions criteria should be regulated at the national and regional levels. The Technology and Economic Assessment Panel had agreed to provide additional information, at the Thirtieth Meeting of the Parties, including on CO_2 emissions associated with the energy consumption of those technologies. She noted that the contact group encouraged parties to discuss those issues bilaterally in advance of the Thirtieth Meeting of the Parties.

38. The Working Group agreed to defer further consideration of the issue to the Thirtieth Meeting of the Parties.

IV. Technology and Economic Assessment Panel 2018 report

39. Introducing item 4 of the agenda, the Co-Chair of the Working Group drew attention to the five volumes of the 2018 report of the Technology and Economic Assessment Panel, and in particular volumes 3 and 4, which addressed the five sub-items listed under agenda item 4.

40. Following a general introduction by the co-chair of the Panel, Mr. Ashley Woodcock, members of the Panel and its technical options committees summarized the findings of the report as follows: Ms. Walter-Terrinoni – Flexible and Rigid Foams Technical Options Committee; Mr. Adam Chattaway – Halons Technical Options Committee; Mr. Roberto Peixoto – Refrigeration, Air-Conditioning and Heat Pumps Technical Options Committee; Ms. Tope – Medical and Chemicals Technical Options Committee; and Ms. Marta Pizano and Mr. Ian Porter – Methyl Bromide Technical Options Committee. Lastly, Mr. Woodcock briefly summarized the administrative issues faced by the Panel. A summary of the presentations, as prepared by the presenters, is set out in section B of annex II to the present report.

41. In the ensuing discussion, Panel members responded to questions and indicated their willingness to discuss the issues in more detail bilaterally with representatives.

42. One representative asked for further information on the availability in Article 5 parties of low-global-warming-potential substances for foams, noting that the topic had been discussed at the recent eighty-first meeting of the Executive Committee of the Multilateral Fund, given the lack of availability of such substances, in particular in Latin American countries. Ms. Walter-Terrinoni replied that the topic would be covered in more detail in the forthcoming assessment report of the Technology and Economic Assessment Panel.

43. Mr. Chattaway, responding to a question on definitions of the terms he had used in his presentation, clarified that "fire protection" was a broad term, encompassing both active protection (fire-suppressing and fire-extinguishing measures) and passive protection (measures designed to

prevent the spread of fire). Since the work of the Halons Technical Options Committee did not cover passive measures, it tended to use the terms "fire protection" and "fire suppression" interchangeably.

44. Asked about the origins of the proposed memorandum of understanding with the International Maritime Organization (IMO), he explained that it had been requested by IMO in order to clarify how it could work with the Montreal Protocol, including on questions of ozone-depleting substances released during ship-breaking and the phase-down of HFCs in ships.

45. Responding to a question about volumes of halons stored in banks, he recalled that the Halons Technical Options Committee had published estimates in previous assessment reports, and would publish further information in the 2018 report. The International Civil Aviation Organization (ICAO) had requested that information from its member States, but had received very little response. Responding to questions about the use of halons and alternatives in aviation, he explained that it was up to national or regional civil aviation organizations to authorize the use of alternatives, but that ICAO was responsible for prohibiting the use of ozone-depleting substances after particular dates. He confirmed that as long as used halons could be cleaned to a sufficient degree, the use of those recycled substances in aviation was a sensible measure; the current supply of halon-1301, for example, was entirely from recycled stocks. If they were contaminated beyond possible use, however, there was no alternative other than destruction.

46. Responding to a number of questions about the use of HFC-1234yf in mobile air-conditioning and refrigeration servicing, Mr. Peixoto said that the substance was increasingly being used in light vehicles in the United States and the European Union, but not, to date, in Article 5 parties, apart from in imported vehicles. Its penetration in the market depended on its costs and the costs of alternatives. After an inquiry regarding trifluoroacetic acid (TFA) as a breakdown product of HFO-1234yf, he and Ms. Walter-Terrinoni stated that the question had been studied by other panels (e.g., the Environmental Effects Assessment Panel) which could provide additional information, but that TFA release had been modelled in the environment related to mobile air-conditioning uses without concern about its background levels. In any case, the use of HFC-134a, which HFC-1234yf was replacing, also resulted in some of the same breakdown products.

47. In response to a question on alternatives to HFCs in high-ambient-temperature conditions, Mr. Peixoto explained that the Refrigeration, Air-Conditioning and Heat Pumps Technical Options Committee had already published information, in previous working group and task force reports, on their energy efficiency, performance and flammability, and would consider the issue in more detail in the Panel's forthcoming assessment report.

48. Responding to a question about the use of HCFCs in fishing vessels, Mr. Fabio Polonara, co-chair of the Refrigeration, Air-Conditioning and Heat Pumps Technical Options Committee, agreed with the point made by one representative, that currently more than 70 per cent of such vessels used HCFC-22 for refrigeration. As the Technical Options Committee had previously stated, the most environmentally sound solution was to continue to use HCFC-22, or a drop-in replacement, until the end of the equipment's life, but new vessels should be fitted with cascade systems using, for example, ammonia or carbon dioxide. The Committee's previous report on the issue had included information about the likely costs.

49. In response to a question on the use of methyl bromide for quarantine and pre-shipment purposes, Ms. Pizano explained that those uses were exempt from controls under the Montreal Protocol.

50. One representative suggested that, given the new challenges to be faced by parties in phasing down HFCs, there was a need to restructure all the assessment panels of the Montreal Protocol, for example, to increase their focus on issues related to climate change.

51. The Working Group took note of the information provided.

A. Nominations for critical-use exemptions for methyl bromide for 2019 and 2020

52. Introducing the item, the Co-Chair of the Working Group referred representatives to the interim recommendations of the Methyl Bromide Technical Options Committee on the critical-use nominations put forward by parties, which had been included in the Panel's presentation and were contained in volume 4 of the Technology and Economic Assessment Panel's report and summarized in paragraphs 20 and 21 of document UNEP/OzL.Pro.WG.1/40/2 and paragraphs 9 and 10 of the addendum thereto (UNEP/OzL.Pro.WG.1/40/2/Add.1).

53. The representative of the European Union observed that all the member States of the European Union had succeeded in phasing out all uses of methyl bromide, which proved that it could be done, and he congratulated China on not putting forward any critical-use nominations in 2018. He expressed concern, however, that the Working Group at the present meeting was not in possession of the whole picture, since observed emissions of methyl bromide appeared to be significantly higher than reported production. He believed that parties, working together with the Methyl Bromide Technical Options Committee, needed to attempt to identify the sources of those emissions, whether they were from stockpiles, unreported consumption, illegal trade, quarantine and pre-shipment purposes or any other source.

54. The representative of Australia, while thanking the Committee for its hard work, nevertheless expressed his disagreement with many of its statements and its interim recommendation on his party's nomination. He intended to take those matters up in detail with the Committee, but since the report was public he felt it necessary to highlight its main shortcomings. In some places the Committee had appeared to diverge from its mandate, which was to provide advice on technical and economic issues, not on matters of policy. In some places it appeared to ignore technical and economic factors. For example, although it had reduced Australia's nomination by 10 per cent based on the recommended use of soilless systems, experience with those systems had shown that they were not economically feasible and could not be used to produce strawberry runners at a reasonable cost; a 10 per cent reduction in methyl bromide use would accordingly lead to a 10 per cent reduction in production.

55. He also expressed his concern about specific statements in the Committee's report. He strongly objected to the implication that Australia's system for chemical registration was too rigorous; rather, it was a very well-regarded system designed to protect human health and the environment. The footnote on page 3 of the text on Australia could be read to imply that companies in Australia were overusing or stockpiling methyl bromide. If that was what was meant, he believed that it was seriously offensive; Australia possessed a highly rigorous approval system which did not lead to those outcomes. If the footnote did not mean that, it needed to be clarified. He also strongly objected to the suggestion in the report that continued approval of parties' critical-use nominations had caused complacency among users and created barriers to the adoption of alternatives. It was a fact that growers of strawberry runners had to be able to use a fumigant; if they did not, they would go out of business. He could not understand how that could be regarded as complacency. He concluded by inviting members of the Committee, and any interested parties, to enter into discussions with representatives of Australian industry, who were present at the meeting, and looked forward to discussing the issues he had raised, and others, bilaterally with the Committee.

56. The representative of Canada said that he agreed with the remarks made by the representative of Australia and similarly disagreed with the Committee's interim recommendation on his party's nomination. He also believed that the Committee had strayed into questions of policy and had made arbitrary decisions that were not based on technical and economic analysis. That was the case, in particular, with respect to the situation in Prince Edward Island. The government of that province had decided to permit the use of only one fumigant for strawberry runners – methyl bromide – in the interests of the health of its citizens, and it was not the Committee's place to challenge or disagree with that decision.

57. He agreed that the adoption of soilless systems as an alternative to methyl bromide would be desirable, but the results of trials so far had not been encouraging. The trials would continue, but the Committee needed to recognize the short window of time in which the research could be conducted, due to the severe winters experienced in the region. The Committee had also appeared to misunderstand the stage of the production process at which the soilless system was being tested. If methyl bromide use was reduced by the proportion recommended by the Committee, production not only of strawberry runners, but also of strawberries in other countries, would suffer. Lastly, he expressed his considerable concern that information provided in confidence to the Committee had been published in the first edition of the Committee's report; although that had now been corrected, it should never have happened.

58. The representative of South Africa stated his disagreement with the Committee's interim recommendation on his party's nomination. His party was fully committed to phasing out all ozone-depleting substances, but there were still two applications of methyl bromide, in mills and in houses, for which no alternative had yet been developed, and some of the alternatives suggested by the Committee were neither viable nor economically feasible. For example, one mill company had tried repeated applications of phosphine to disinfest a badly contaminated shipment of wheat and maize, but that had not worked, and the company had been forced to use methyl bromide. New alternatives were being developed, and his Government always fast-tracked applications for use, but trials still needed to be run on their effectiveness. In the light of that, he failed to understand the Committee's

recommendation for a reduction in his party's nomination, and he looked forward to discussing the matter further.

59. The representative of Argentina said that she agreed with the need to reduce the use of methyl bromide, and she accepted the Committee's interim recommendation for her party's nomination. She noted, however, that there was still a continuing need for the use of methyl bromide by tomato and strawberry producers in her country, and that the use of barrier films was proving prohibitively expensive and was not viable on a large-scale level.

60. Another representative, whose party had not put forward a critical-use nomination, stated that he nevertheless endorsed the concerns expressed by other representatives. It was essential that the Committee avoid arbitrary decisions and be clear and transparent about the justification for its recommendations; that it respect national and local regulations and policy decisions; that it avoid using pejorative language such as "complacency"; and that it avoid making subjective judgments. It also needed to be very careful not to release confidential information. He cautioned against entering into any wider discussion of the questions that had been raised about production and emissions of methyl bromide before hearing further information about scientific observations of atmospheric concentrations.

61. The Co-Chair encouraged all interested parties to arrange bilateral meetings in the margins of the meeting with the Committee to discuss its recommendations in more detail. The Committee would produce a final report on the evaluation of the nominations taking into account additional information provided by the nominating parties. Parties would return to the topic at the Thirtieth Meeting of the Parties in November 2018.

62. He noted that the nominating parties would be conducting bilateral discussions with the Committee and that the final recommendations would be considered by the Thirtieth Meeting of the Parties, in November 2018, based on the final report of the Committee, which would be issued in advance of the meeting.

B. Progress in the implementation of decision XXIX/8 on future availability of halons and their alternatives

63. The Co-Chair introduced the sub-item, recalling that relevant information had been provided by the Technology and Economic Assessment Panel in its presentation on volumes 3 and 4 of its 2018 report for item 4. More details could be found in the report of the Halons Technical Options Committee in section 3.4 of volume 3 of the Panel's 2018 report, in paragraphs 22 and 23 of document UNEP/OzL.Pro.WG.1/40/2 and in paragraphs 11 to 14 of the addendum thereto (UNEP/OzL.Pro.WG.1/40/2/Add.1).

64. With regard to the possibility of concluding a memorandum of understanding with the International Maritime Organization in order to be better able to assess the quantity of halons installed on merchant ships, and the quantity and quality of halons being recovered from ship-breaking activities, several representatives underscored the importance of obtaining such information, with two explaining that they were in bilateral discussions with the Halons Technical Options Committee with regard to the involvement of the parties in concluding the memorandum. Another representative said that parties should provide input to the content of the memorandum of understanding and mooted the drafting of a related decision.

65. In relation to halons, one representative urged all parties to continue working on the collection and recycling of halons and on ensuring that they could expedite the transfer of the gases across national borders for the purpose of such collection and recycling. Another representative supported the proposal that the Halons Technical Options Committee change its name to reflect work more broadly on issues related to the fire protection sector.

66. At the request of one party, the Working Group agreed that further informal consultations on the matter would continue in the margins of the meeting.

67. One representative later reported that the consultations had not yet succeeded in identifying a way forward and that further discussion would be needed.

68. The Working Group agreed to defer further consideration of the issue to the Thirtieth Meeting of the Parties.

C. Development and availability of laboratory and analytical procedures that can be performed without using controlled substances under the Protocol (decision XXVI/5)

69. The Co-Chair introduced the sub-item, recalling that the representative of the Technology and Economic Assessment Panel, in her presentation on volumes 3 and 4 of its 2018 report for item 4, had stated that the Panel and its Medical and Chemicals Technical Options Committee were preparing a report in response to decision XXVI/5 on the development and availability of laboratory and analytical procedures that could be performed without using controlled substances, for consideration by the Thirtieth Meeting of the Parties. More details could be found in the report of the Medical and Chemicals Technical Options Committee in section 8 of volume 3 of the Panel's 2018 report, and in paragraphs 15 and 18 of document UNEP/OzL.Pro.WG.1/40/2/Add.1.

70. One representative acknowledged the challenges faced by the Medical and Chemicals Technical Options Committee in obtaining consistent up-to-date information on standards applicable to the laboratory and analytical uses of ozone-depleting substances. He urged parties to gather information and provide it to the Committee so that it could complete its report in time for consideration by the Thirtieth Meeting of the Parties.

D. Process agents (decision XVII/6)

71. The Co-Chair introduced the sub-item, recalling that the Technology and Economic Assessment Panel, in its presentation on volumes 3 and 4 of its 2018 report for item 4, had said that it and its Medical and Chemicals Technical Options Committee had reviewed the information submitted on the quantities of ozone-depleting substances produced or imported for process agent applications, on make-up, on levels of emissions and on containment technologies. More details could be found in section 5.3 of volume 3 of the Panel's 2018 report, in paragraphs 25 to 28 of document UNEP/OzL.Pro.WG.1/40/2 and in paragraphs 19 to 25 of the addendum to that document.

72. The Panel and its Medical and Chemicals Technical Options Committee had suggested the removal from table A of decision XXIX/7 of the use of CFC-113 in the preparation of perfluoropolyether diols; the updating of the same table by the removal of the European Union from under the application "chlorine recovery by tail gas absorption in chlor-alkali production"; and the reduction of the quantities of make-up/consumption and maximum emission levels contained in table B of decision XXIII/7 to take into account the process-agent uses and emissions currently reported. Further information thereon could be found on pages 27 and 28 of volume 3 of the Technology and Economic Assessment Panel's 2018 report and in tables 2 and 3 in the addendum to the note by the Secretariat (UNEP/OzL.Pro.WG.1/40/2/Add.1).

73. The Working Group agreed to defer further consideration of the issue to the Thirtieth Meeting of the Parties.

E. Organizational and other matters

74. Introducing the item, the Co-Chair encouraged parties first to consider the issue of the members of the Technology and Economic Assessment Panel whose term would expire at the end of 2018, listed in table 4 of the addendum to the note by the Secretariat (UNEP/OzL.Pro.40/2/Add.1). Paragraphs 25 to 30 of the note summarized the procedures relevant to nomination and appointment of Panel members.

75. She recalled that appointments to the Technology and Economic Assessment Panel, including to the positions of co-chairs of the technical options committees, would be made through a decision of the meeting of the parties.

76. Nominations of members of the technical options committees, with the exception of their co-chairs, could be made directly by parties, including at the suggestion of co-chairs of the Panel or the committees. All such nominations should be made in full consultation with the national focal point of the relevant party and would need to be sent to the co-chairs of the Committee and the Panel for confirmation. That process could be followed at any time, as a decision of the meeting of the parties was not required. She drew attention to annex IV to the addendum to the note by the Secretariat (UNEP/OzL.Pro.40/2/Add.1), which listed the members of the technical options committees whose membership would expire at the end of 2018.

77. She suggested that the Working Group should not enter into a discussion on specific nominations, but requested parties that were interested in nominating members to consult the members of the Technology and Economic Assessment Panel and the technical options committees and representatives of other parties informally. Any nomination for membership of the Panel could be

submitted by a nominating party to the Secretariat in the form of a conference room paper, for consideration by the Thirtieth Meeting of the Parties. Any nominations to the committees could be sent to the Secretariat, who would forward it to the co-chairs of the Panel and the relevant committee. She drew attention to the "matrix of needed expertise" contained in annex 2 to volume 3 of the 2018 progress report of the Technology and Economic Assessment Panel, provided by the Panel in accordance with its terms of reference, which identified the areas of expertise necessary to respond to requests by the parties.

78. In the absence of any comments on that proposed way forward, she then invited representatives to comment on any organizational and other matters relevant to the Technology and Economic Assessment Panel. She drew attention to paragraphs 31 to 35 of the addendum to the note by the Secretariat (UNEP/OzL.Pro.40/2/Add.1), which provided a brief summary of some of the other substantive issues and challenges relating to the operation of the Panel.

79. Representatives applauded the work of the Technology and Economic Assessment Panel in providing comprehensive advice on technical and economic matters, often to very short deadlines, to assist the parties in reaching their decisions, recognizing in particular that members of the Panel generally undertook their work on a voluntary basis, alongside their employment. One representative said that the burden now being placed on the Panel was unsustainable, and that parties should review carefully the requests they made of the Panel. In particular, parties should consider whether update reports could be produced less frequently. It was suggested that the Secretariat could facilitate a discussion on that topic at the Thirtieth Meeting of the Parties by drawing up a list of current requirements of the Panel to produce reports and updates. Parties also needed to be more disciplined in requesting the Panel to produce special reports, and the Panel needed to be clear in telling the parties what was achievable.

80. Other representatives agreed, highlighting in addition the extra burdens expected to be placed on the Panel by the implementation of the Kigali Amendment. Representatives also drew attention to the challenges faced in identifying potential members with both the appropriate expertise and sufficient time to devote to the work.

81. The representative of Brazil drew attention to the recent death of Ms. Raquel Ghini, who had served as a member of the Methyl Bromide Technical Options Committee from 2009 to 2016, and who had been instrumental in assisting Brazil to phase out the use of methyl bromide. She expressed her appreciation for Ms. Ghini's work and her condolences to her family.

82. The Working Group agreed to the suggestion that the Secretariat should compile a list of requests to the Technology and Economic Assessment Panel for reports, for discussion by the Thirtieth Meeting of the Parties.

V. Linkages between hydrochlorofluorocarbons and hydrofluorocarbons in transitioning to low-global-warming-potential alternatives (UNEP/OzL.Conv.11/7–UNEP/OzL.Pro.29/8, para. 162)

83. The Co-Chair of the Working Group recalled that the issue of linkages between HCFCs and HFCs had been introduced by the Government of Saudi Arabia at the combined eleventh meeting of the Conference of the Parties to the Vienna Convention and Twenty-Ninth Meeting of the Parties to the Montreal Protocol. The discussions that had taken place at that time were reflected in paragraphs 153 to 162 of the report of the meeting (UNEP/OzL.Conv.11/7– UNEP/OzL.Pro.29/8). The key points were also summarized in paragraphs 31 to 33 of document UNEP/OzL.Pro.WG.1/40/2. The Twenty-Ninth Meeting of the Parties had agreed that the issue be included in the agenda of the present meeting of the Open-ended Working Group.

84. By way of introduction, the representative of Saudi Arabia said that the aim at the present meeting was to agree on a clear and actionable way forward with regard to the concerns that had been expressed by parties, including in relation to the availability of suitable technology and substances to carry out the transition to alternatives with low-global-warming potential, in particular to avoid double conversions, and on the need to develop a mechanism to make operational the provisions of paragraphs 6 to 8 of decision XXVIII/2 of the Twenty-Eighth Meeting of the Parties.

85. A major fear for his country, which had developed an ambitious plan for the accelerated phase-out of HCFCs, was that efforts to meet HFC phase-down obligations would hinder the implementation of that plan; he therefore called for a review of the HCFC-related implementation

schedule. He also called on the Technology and Economic Assessment Panel to provide guidance in that regard.

86. Several representatives agreed on the need to discuss the matter further and to obtain more information thereon. Two of them supported the preparation of a report by the Technology and Economic Assessment Panel. A number of representatives highlighted specific issues that their countries were facing. One representative mentioned the huge increase in the import and use of HFC-based air-conditioning equipment that could put his country at risk of non-compliance in future years; another, a representative of a country with high-ambient-temperature conditions, explained that, in his country's experience, HCFC-22-based equipment was not efficient in temperatures higher than 45°C. A third representative explained that his country was moving directly from HCFCs to hydrocarbons, avoiding conversion to HFCs. All the representatives who spoke stressed the need to find solutions to the challenges they were facing and ensure that their countries remained in compliance with the Montreal Protocol. One representative, acknowledging that the issue under consideration did indeed affect countries with high ambient temperatures, nevertheless pointed out that its impact was not limited to those countries.

87. Other issues were raised as meriting further consideration, including energy efficiency; the costs of natural refrigerants; related standards and norms; knowledge transfer for technicians and engineers; the adequacy of the supply of HCFCs; and stockpiles. Several representatives re-emphasized the need to avoid double conversions, not least owing to the financial implications for countries and for the Multilateral Fund and its donors.

88. Several representatives said that the discussions and any action taken should build on decision XXVIII/2, which provided a solid base and outlined the overarching process, while one said that, given that the topic was linkages between HCFCs and HFCs, decision XIX/6 should be taken into account in order to ensure a holistic approach.

89. The Working Group agreed to establish a contact group, to be chaired by Obed Baloyi (South Africa) and Philippe Chemouny (Canada) to discuss the issue further.

90. Reporting on the progress made by the contact group, the co-chair of the group said that parties had discussed the need for flexibility in avoiding double conversions from HCFCs where no lower-global-warming-potential alternatives were available, and had identified ideas for further discussion. Potential measures that could be adopted included deferring consideration of the compliance status of countries with high ambient temperatures in 2025 and 2026 for substances used in the specific refrigeration and air-conditioning subsectors listed in decision XXVIII/2, with the possibility of the extension of the measure for a further two years; extending that measure to other subsectors facing similar challenges; and, as a last resort, adjusting the HCFC phase-out schedules to avoid the need for double conversions.

91. Looking forward to future discussions, he suggested that it would be helpful to identify more precisely the anticipated scope and timing of the likely problems, and he encouraged parties to pose questions to affected parties, who could share their experiences and thinking. The Technology and Economic Assessment Panel had been requested to provide more information on the alternative technologies available in different countries and regions, and some parties were considering submitting proposals on flexibility measures to the Thirtieth Meeting of the Parties. Other issues had been raised that the co-chairs of the contact group felt fell outside the group's remit, but they could be raised under other agenda items.

92. The Working Group agreed to defer further consideration of the issue to the Thirtieth Meeting of the Parties.

VI. Issues related to energy efficiency while phasing down hydrofluorocarbons (decision XXIX/10)

A. Report by the Technology and Economic Assessment Panel on energy efficiency in the refrigeration, air-conditioning and heat pump sectors

93. Introducing the sub-item, the Co-Chair of the Working Group drew attention to volume 5 of the 2018 report of the Technology and Economic Assessment Panel, containing the decision XXIX/10 task force report on issues related to energy efficiency while phasing down HFCs, and to the executive summary of the report set out in annex V to document UNEP/OzL.Pro.WG.1/40/2/Add.1.

94. Presentations summarizing the main findings of the report were then made by Ms. Bella Maranion (United States), Co-Chair of the Technology and Economic Assessment Panel, Mr. Polonara

(Italy), co-chair of the Refrigeration, Air-Conditioning and Heat Pumps Technical Options Committee, and Ms. Suely Carvalho (Brazil), senior expert.

95. A summary of the presentations, as prepared by the presenters, is set out in section C of annex II to the present report.

96. In the ensuing discussion, all the representatives who spoke expressed appreciation to the task force for the quality of its report, which had been prepared in an extremely short period of time.

97. One representative requested further information on the current availability of low-global-warming-potential alternative refrigerants, such as R-290; on the cost differences, which, as suggested in the presentation, might prove a disincentive to consumers with equipment using variable speed drives, or inverters; on the effectiveness of improved systems in ambient temperatures exceeding 40°C; and on the reasons for using CO_2 equivalence as an indicator. Another representative asked for the task force's views on the types of alternative refrigerants that could, according to the report, contribute to energy efficiency improvements of up to 10 per cent in the context of the HFC phase-down; on whether other aspects should also be considered; and on the role of buyers' clubs in meeting the capacity-building and training needs for improving efficiency. A third representative sought clarification as to whether the task force had determined that refrigerant choice, which had a relatively minor impact on energy efficiency, would lead to a general increase or decrease in efficiency when transitioning to low-global-warming-potential alternatives. Another representative requested further information on the estimated cost increases associated with the switch to more energy-efficient technologies.

98. Mr. Polonara, responding to the questions, said that R-290 would be relatively easy to obtain once its flammability, among other things, had been determined and it became a low-global-warming-potential alternative of choice, in particular for small-scale applications. Problems with regard to the availability of the substance lay in the fact that it was currently in use in only a limited range of applications. No information was available on the likely cost differences, although current trends related to system components, such as the inverter, suggested that prices would eventually fall as a result of economies of scale. On the reasons for using CO_2 equivalence as an indicator, as opposed to energy efficiency ratios, he said that it was better suited to assessing a wider range of ambient temperature conditions, from moderate to extreme, and that it would also serve to determine the energy efficiencies achievable in countries with ambient temperatures in excess of 40°C. On the question of the impact of alternative refrigerant use, he said that refrigerant choice was probably dictated by variables other than energy efficiency, meaning that it was indeed important to look at all aspects, in particular the optimization of system components and design once a specific refrigerant had been chosen for a specific application. As to whether the estimated 5 to 10 per cent change would be positive or negative, he said that that would remain unclear until the impact of the alternatives nearing approval had been ascertained.

99. Ms. Carvalho, responding to the question of the role of buyers' clubs, said that the task force regarded them as an effective means of achieving economies of scale for new technologies, as long as they were supported by appropriate policymaking.

100. One representative, supported by two others, requested clarification of the changes in unit size and design required for the transition to more energy-efficient alternatives, especially in high-ambient-temperature countries, which lacked the requisite guidance from the Montreal Protocol and other United Nations entities to meet the unique challenges that they faced in terms of, among other things, servicing requirements and increased costs. Those challenges could be addressed at a future workshop held in one of those countries. Another representative added that the report did not include any information from studies of the refrigeration sector conducted at the regional level, in particular in regions containing high-ambient-temperature countries.

101. Responding to those questions, Mr. Bassam Elassaad, a member of the task force, said that work to identify the challenges facing high-ambient-temperature countries had been under way for some time; that the global supply chain was currently slow to respond; and that the updated report would reflect the outcomes of the continuing study of system design optimization for those countries, as well as the research conducted by local industries on unit size and differing safety codes in relation to, among other things, flammability and larger refrigerant charge requirements. Responding to a further request for clarification on deadlines for including information in the updated version of the report, he pointed out that a project seeking to identify low-global-warming-potential alternatives for the air-conditioning sector in high-ambient-temperature countries was focusing on prototypes to assist the research and development departments of local industries in optimizing the design of previously identified refrigerants, and on carrying out a risk assessment. The deadline for the delivery of the

project results, however, might come too late for their inclusion in the updated report, which was also expected to include information from local experts working in consultation with local manufacturers.

102. One representative, calling for the key messages from the energy efficiency workshop to be distilled and passed on to the Panel for further consideration, drew attention to a number of inconsistencies between the information provided by the Panel task force in its report and by the authors of the cited studies, such as on the links between energy efficiency and cooling performance, and a briefing note prepared for the workshop, on the benefits to the refrigeration, air-conditioning and heat pump sectors of transitioning to low-global-warming-potential alternatives. He requested the task force, when updating its report, to address those inconsistencies; to ensure that qualitative assertions, such as on the significant impact of local circumstances in relation to environmental benefits in terms of CO_2 equivalence, were quantified; and to include, in the section on funding institutions, an indication of the institutions' technological criteria. Another representative requested quantitative information on the total funding allocated by the financial institutions to energy efficiency work, on energy efficiency improvements to date and on factors such as improved building design. A third representative requested information on the amounts of funding allocated to various projects, while a fourth asked whether the funding institutions had any guidelines specific to energy efficiency-related funding and how much of that would be accessible to Article 5 parties.

103. Responding to the questions on the various gaps and inconsistencies, Mr. Polonara said that both energy efficiency and cooling capacity had indeed been considered by the task force in its work on the optimization of system components and design for specific applications. He added that both those factors would be reflected and any informational inconsistencies corrected in the updated report. Ms. Maranion, echoing those comments, said that the information provided by the Secretariat in preparing the workshop had appeared entirely consistent, and that any additional information relevant to points mentioned would be taken on board. The outcomes of the workshop, she added, would be reflected in the updated report. Ms. Carvalho explained that the task force had been unable to include more extensive information on funding issues in the current version of the report owing to the tight deadline for its delivery to the Open-ended Working Group, adding that the additional information requested on the matter could be provided in the supplemental report. Funding to assist countries with economies in transition was made available under an agreement between the Montreal Protocol and the Global Environment Facility. Only 200 of the 1,000 projects funded under the Facility's climate mitigation focal area, however, related to the refrigeration, air-conditioning and heat pump sectors, and some of the projects had received additional funding, as demonstration projects, from the Multilateral Fund.

104. One representative sought further clarification of the contribution of the Multilateral Fund, adding that energy efficiencies could be achieved through tackling the energy costs linked to the equipment used rather than the cost of refrigerants, which was relatively low. Another representative pointed out that the report did not make clear the relationship between energy efficiency studies and the Kigali Amendment.

105. The Co-Chair of the Working Group suggested that any parties with further questions should meet bilaterally with the members of the task force in the margins of the present meeting.

B. Outcome of the workshop on energy efficiency opportunities while phasing down hydrofluorocarbons

106. The Co-Chair of the Working Group recalled that, in decision XXIX/10, the Twenty-Ninth Meeting of the Parties had requested the secretariat to organize a workshop on energy efficiency opportunities while phasing down HFCs at the fortieth meeting of the Open-ended Working Group. Accordingly, the workshop had been held in Vienna on 9 and 10 July 2018, immediately prior to the present meeting. One of the rapporteurs of the workshop, Mr. Mark Radka, Chief of the Energy, Climate and Technology Branch, Economy Division of the United Nations Environment Programme, presented the workshop report (UNEP/OzL.Pro.WG.1/40/6).

107. In the ensuing discussion, while some representatives expressed their appreciation for the workshop, others expressed their disappointment, suggesting that it had been too general in relation to the topic of energy efficiency, with insufficient focus on the direct link between energy efficiency and the phase-down of HFCs. The workshop had not, they said, fulfilled the mandate set out in decision XIX/10 and, consequently, had not produced the expected results, representing a missed opportunity to clarify issues, answer concrete questions and give specific guidance to parties. Any future such workshop should involve more fully the proponents of the related decision taken by the parties as well as the Technology and Economic Assessment Panel. One representative, speaking on behalf of a group of parties, recalled the request made by one party during the workshop, as captured in the report of the workshop, and asked that a tabular overview be produced by the Secretariat or the Technology and

Economic Assessment Panel task force on the funding opportunities available to developing countries and the scope and type of measures eligible for funding, including the mechanism of access and other relevant details.

108. The Co-Chair asked the representatives of the Panel, in their presentation of the report of the Panel under agenda item 6 (a), on the report by the Panel on energy efficiency in the refrigeration, air-conditioning and heat pump sectors, to describe how the Panel was intending to take on board the discussions and outcomes of the workshop.

109. Mr. Radka said that he considered the report to be a good reflection of the way the workshop had been structured in terms of the presentations given and the points made during the discussions. The workshop had dealt mainly with the topic of energy efficiency in the design of new and existing refrigeration and air-conditioning equipment and systems, but there had been many other relevant elements in the presentations, including, for example, the relative thermo-dynamic efficiency of various refrigerants and the impact of that on the overall energy efficiency of a system. He highlighted one of the outcomes of the workshop, namely that although refrigerant choice was an important consideration in the overall energy efficiency of a system, it was not the dominant feature.

110. One representative suggested reworking the report to make the elements of energy efficiency related to HFC phase-down clearer, in particular regarding the impact of the selection of the refrigerants on energy efficiency, the cost of new energy efficient technologies and funding issues. According to the party, there were three take-away messages from the workshop: the cost "hump" in the uptake of new energy-efficient technologies, the impact of the selection of the refrigerant on energy efficiency, and the fact that available funds were not easily flowing for energy efficiency technologies.

111. One representative suggested that mention should be made in the workshop report of lessons learned in Ghana, which demonstrated that together, minimum energy performance standards, labelling, a second-hand import ban and a replacement programme had transformed the refrigerator market in Ghana, saving 400 Gwh, recovering 1,500 kg of CFCs, and avoiding 1.1 million tonnes of CO_2 emissions.

Discussion on energy efficiency issues taking into account agenda items 6 (a) and (b)

112. The Co-Chair then invited representatives to participate in a general discussion on the issue of energy efficiency while phasing down HFCs.

113. Representatives thanked the Technology and Economic Assessment Panel for its hard work in producing its report, and stressed the importance of the topic, given the impact on climate change not only of the refrigerants used in equipment but of the energy consumed during its operation. That was true in particular for space cooling, the demand for which was anticipated to rise steeply in the future. Implementing improvements in energy efficiency had implications for the design of equipment, its manufacture and its maintenance and servicing, and had the potential to deliver significant benefits, including not only a reduction in emissions but also lower costs to consumers and lower peak loads on electricity grids.

114. One representative observed that improvements in energy efficiency had always been one of the co-benefits of actions taken under the Montreal Protocol, as new technology adopted under successive transitions away from ozone-depleting substances had always been more efficient than the equipment it replaced, although that had not been the central purpose of the phase-out. It was clear that parties needed to look much more deeply into the topic, but that they should do so in the awareness that considerable amounts of expertise, resources and activities lay outside the institutions of the Montreal Protocol. It would be important, therefore, for parties to establish contacts with the relevant regulatory bodies in their own countries, and for the Protocol as a whole to avoid duplicating the work of other bodies or attempting to exercise influence over policy decisions that lay outside its jurisdiction. The Montreal Protocol should stick to its areas of core competence and experience.

115. Questions relating to the costs of equipment were critical. As had been pointed out in the Panel's presentation, it was important to consider the full life-cycle cost of the equipment; equipment with a high initial capital cost often had a lower life cycle cost.

116. Many representatives highlighted the need for assistance to Article 5 parties to ensure they were able to realize the potential gains of energy efficiency measures. That assistance included institutional strengthening activities, support for regional networks, training and capacity-building, in particular for technicians responsible for maintaining and servicing equipment, and technology transfer.

117. Representatives asked in particular for assistance with accessing sources of finance and support for capacity-building. Some recalled the commitment of the World Bank to provide $1 billion in lending for energy efficiency investments in urban areas, as part of its Climate Change Action Plan, and indicated that they would welcome further information on that topic at a future meeting. One representative observed that the Executive Committee was currently unable to approve funds for energy efficiency improvements because that lay outside the definition of incremental costs approved by meetings of the parties. At the same time, parties were often unable to access funding for those improvements from other institutions because the Montreal Protocol already possessed its own financial mechanism. It was important for parties to discuss how energy efficiency improvements could be financed under the Protocol.

118. Several representatives asked the Panel to provide more information in its updated report, including on the performance of low-global-warming-potential refrigerants (including information on their flammability and performance in different environments); possible policy measures that could be adopted, such as minimum energy performance standards, and countries that were already employing them; heat pumps; the barriers to the adoption of energy efficiency measures, and means of removing them; and estimates for the length of time needed to introduce alternatives.

119. Several representatives, highlighting the large volume of information available from various sources, suggested that the Technology and Economic Assessment Panel could help the parties by presenting key issues in a concise way, including information on new substances and technologies and their performance and management. Representatives requested the Panel to compile a concise list of all sources of funding available to support energy efficiency activities connected to the HFC phase-down.

120. One representative, however, felt that the Panel had not fulfilled the mandate given to it by decision XXIX/10 of the Twenty-Ninth Meeting of the Parties. Whereas that decision had requested the Panel to provide information related to maintaining and/or enhancing energy efficiency in the refrigeration, air-conditioning and heat-pump sectors while phasing down HFCs, in fact the Panel had provided information on energy efficiency issues more generally. In particular, it had not taken into account the relative performance of alternative substances. He requested the Panel to include in its updated report clear and concise information on technology options; requirements for uptake, capacity-building and servicing (including in particular servicing with flammable refrigerants), and the related incremental capital and operating costs; the concept of the "cost hump", related to the high upfront costs of energy efficient equipment, along with the importance of financial measures to overcome it; and the estimated costs of the technical interventions mentioned in the Panel's report.

121. Another representative agreed, arguing that both the Panel's report and the workshop should have been more focused. Topics such as minimum energy performance standards fell outside the remit of the Montreal Protocol. Issues related to climate change should be discussed in the context of the United Nations Framework Convention on Climate Change, and parties to the Montreal Protocol should discuss only issues related directly to the replacement of refrigerants.

122. Several representatives requested the Secretariat to arrange an informal group in which parties could discuss with the Panel the issues they would like to see included in its updated report for the Thirtieth Meeting of the Parties.

123. Subsequently, the representative of Rwanda introduced a conference room paper, containing a draft decision relating to sub-items 6 (a) and (b), on behalf of the African Group.

124. The Working Group agreed to establish a contact group, co-chaired by Leslie Smith (Grenada) and Patrick McInerney (Australia) to discuss the draft decision.

125. Reporting back, the co-chair of the contact group said that the group had developed additional guidance on energy efficiency for the Technology and Economic Assessment Panel, which had been posted on the meeting portal. The additional guidance to the Panel is reproduced in annex III to the present report, without formal editing. Members of the Panel had said that, although they had only four more weeks in which to finalize the Panel's report, they would do their best to address both the additional guidance and the interventions made by parties at the present meeting.

126. The contact group had discussed the conference room paper submitted by Rwanda on behalf of the African Group. A number of elements had been seen as useful, but it had been agreed that further consideration was needed with regard to how they fitted into the framework of the Montreal Protocol and how they related to decision XXVIII/2, particularly paragraphs 16 and 22, and to the ongoing work of the Executive Committee. Further discussion of how the proponents foresaw the implementation of those elements was also required.

127. The Working Group agreed to forward the draft decision, as set out in section B of annex I to the present report, to the Thirtieth Meeting of the Parties for further consideration.

VII. Requirements for hydrochlorofluorocarbons for the period from 2020 to 2030 for parties not operating under paragraph 1 of Article 5 of the Protocol (decision XXIX/9)

A. Report by the Technology and Economic Assessment Panel on hydrochlorofluorocarbons and decision XXVII/5

128. The Co-Chair introduced the agenda item, recalling that, by decision XXIX/9, the Twenty-Ninth Meeting of the Parties had requested the Technology and Economic Assessment Panel to assess the HCFC requirements, for the period 2020 to 2030, of non-Article 5 parties, in terms of the type of use, the volumes for different applications, and alternatives for those applications. The possibility of meeting needs through the use of recycled or reclaimed HCFCs was also to be assessed.

129. The report by the Panel and its working group had been made available as part of volume 1 of the Panel's 2018 progress report, and the executive summary of that report was set out in annex III to document UNEP/OzL.Pro.WG.1/40/2. Paragraph 43 of the document briefly summarized the key points of the executive summary.

130. The co-chairs of the decision XXIX/9 working group of the Technology and Economic Assessment Panel, Mr. Chattaway and Ms. Tope, introduced the report. Following the presentation, there were several requests for further clarification.

131. Responding to requests for clear definitions of the terms "fire protection" and fire suppression", Mr. Chattaway explained that "fire protection" was a term used very broadly in the fire industry to cover passive fire protection, such as panels, and all means of extinguishing a fire, such as sprinklers, and in the broadest sense even encapsulated fire detection, such as smoke alarms. "Fire suppression" could be seen as the active process of extinguishing a fire, for example, by means of halons, HCFCs, HFCs, an inert gas or carbon dioxide. It could also, in a specialized sense, mean the process of controlling a fire, but not putting it out, for example, in the cargo hold of an aeroplane in order to enable it to land safely. For the purposes of the Panel's report, however, the terms "fire protection" and "fire suppression" were synonymous.

132. Ms. Tope confirmed that the report related only to non-Article 5 parties, with one representative recalling that the mandate for the report stemmed from decision XIX/6. In paragraphs 12, 13 and 14 of that decision, the parties had agreed to address the possibilities or need for essential-use exemptions, no later than 2015 where it related to non-Article 5 parties and no later than 2020 where it related to Article 5 parties. The parties had also agreed to review in 2015 the need for the 0.5 per cent for servicing for non-Article 5 parties, and to review in 2025 the need for the annual average of 2.5 per cent for servicing for Article 5 parties. In order to satisfy basic domestic needs, the parties had agreed to allow for up to 10 per cent of baseline levels until 2020, and, for the period after that, to consider, no later than 2015, further reductions of production for basic domestic needs.

B. Proposed adjustments to the Montreal Protocol

133. The Co-Chair drew attention to the two proposals for adjustments to the Montreal Protocol that had been received, for consideration by the Thirtieth Meeting of the Parties, within the six months prior to that meeting, as per the procedure specified in the Protocol. One proposal had been submitted jointly by the Governments of Australia and Canada (UNEP/OzL.Pro.WG.1/40/5), while the other had been submitted by the Government of the United States (UNEP/OzL.Pro.WG.1/40/4). Background information and a summary of each of the proposals was set out in paragraphs 51 to 53 of document UNEP/OzL.Pro.WG.1/40/2/Add.1. The Co-Chair invited the proponents to introduce their proposals.

134. The representative of Australia, speaking on behalf of her Government and the Government of Canada, stressed that the need to review and fine-tune the Montreal Protocol after 2020 had been built into the Protocol itself through the adjustment in 2007 and paragraphs 12, 13 and 14 of related decision XIX/6 of the Nineteenth Meeting of the Parties. She said that she saw the review process, the report by the Technology and Economic Assessment Panel and the adjustment proposal as part of a normal housekeeping exercise to ensure that the Protocol continued to function effectively. The purpose of the proposal was to permit essential-use exemptions for HCFCs to be considered and authorized by meetings of the parties, by means of a process similar to that for other ozone-depleting substances, and to extend the use of the existing 0.5 per cent servicing tail from 2020 to 2030 to the servicing of fire protection equipment installed before 2020, in addition to refrigeration and

air-conditioning equipment. Through essential-use exemptions, the proposal sought to ensure that HCFCs would continue to be available for laboratory and analytical uses after 2020, a need that had been confirmed by the Technology and Economic Assessment Panel.

135. The representative of the United States introduced his Government's proposal, noting that it contained only one element, namely the extension of the servicing tail. He said that, although the wording might differ, the basic policy intent of his Government's proposal was the same as that of the proposal by the Governments of Australia and Canada. Reiterating that the review stemmed from decision XIX/6, he explained that the specific timing and scope of the review related to the onset of the servicing tail for non-Article 5 parties. The Technology and Economic Assessment Panel report had recognized the need for HCFCs for fire suppression applications. In his country, that pertained to aircraft rescue and firefighting applications. The proposal stemmed from the fact that the equipment used in such applications required significant capital expenditure for equipment with a lifetime of more than a decade. The aim was to avoid the premature retirement of working equipment. The proposed adjustment was narrow in scope and tailored to a specific need.

136. The proponents of both proposals stressed that they were not seeking to increase the serving tail amount. It would remain at 0.5 per cent of the baseline, and the use of HCFCs would not be permitted for non-servicing purposes or for new equipment. They both underlined the public health aspect of the applications in question.

137. In the ensuing discussion, the proponents of the proposals responded to a number of questions from the other parties.

138. With regard to the suggestion that they could have chosen to apply for an essential-use exemption for fire-suppression applications rather than adjusting to the servicing tail, they explained that an essential-use exemption would lead to additional HCFC use, whereas the proposal was for their use for the servicing of fire protection and suppression equipment to fall within the 0.5 per cent tail already agreed by the parties for refrigeration and air-conditioning servicing. It was considered more restrictive than an essential-use exemption and made more sense from an environmental point of view. Furthermore, the representative of Canada explained that the specification of refrigeration and air-conditioning servicing as the sole use of the servicing tail had been added to the Protocol by means of an adjustment in 1995, and legal advice had suggested that the addition of the servicing of fire protection equipment could be undertaken in the same way.

139. Several representatives of Article 5 parties said that adjustments and amendments should be used cautiously and sparingly, noting that many such parties were struggling with implementation but had not made proposals for adjustments. One representative expressed the hope that any possible future proposal to adjust the HCFC phase-out schedule of his country, pursuant to the discussions under agenda item 5, on linkages between HCFCs and HFCs in transitioning to low-global-warming-potential alternatives, would be broached as openly as the two proposals under consideration.

140. With regard the future servicing tail for non-Article 5 parties, it was pointed out that decision XIX/6 allowed such parties to review the matter at any time up to 2020, and that it was their prerogative to decide when they wished to do so.

141. In response to a suggestion that the two proposals be merged, the representative of the United States reiterated that there was little difference between the proposals to extend the use of the servicing tail to fire suppression equipment, but that his country had no use of HCFCs for laboratory and analytical uses, so it made little sense for it to present such a proposal. One representative suggested that the merging of the two proposals could be done by the Working Group or in a contact group. He and another representative said that their countries had also identified the need for HCFCs for laboratory and analytical uses. Another representative said that the issue required further clarification and mooted the idea of a specific mention thereof in the wording of the proposed adjustment.

142. One representative proposed unifying the terminology used with regard to "fire protection" and "fire suppression". Other representatives requested further consideration of the two terms as there could be relative advantages and disadvantages to the use of one or the other.

143. A number of issues for further consideration were raised, including matters raised in the report of the Technology and Economic Assessment Panel, but not addressed by the proposals, such as possible needs for solvent applications, including for servicing, and the potential to increase the use of recycled or reclaimed HCFCs.

144. The Working Group agreed to establish a contact group, co-chaired by Ms. Laura Beron (Argentina) and Mr. Davinder Lail (United Kingdom), to discuss the issue further.

145. Following the initial discussions in the contact group, the representative of the Russian Federation said that he had proposed, in the contact group discussions, that consideration be given to the inclusion of aerospace industry and medical applications in the adjustment to the Montreal Protocol proposed by the United States in order to allow the use of HCFCs for such applications beyond 2020. He provided proposed text and presented a copy to the Secretariat for consideration by the Working Group in a contact group set up to consider the adjustment proposals.

146. Reporting back, the co-chair of the contact group said that the group had discussed a number of issues, including whether there should be single adjustment applying both to Article 5 and non-Article 5 parties; which sectors should be addressed, including whether fire protection or fire suppression, laboratory and analytical uses, and aerospace and medical uses should be included in the adjustment; whether the need for such uses could be addressed within the 0.5 per cent servicing tail or as essential-use exemptions, and which approach was best on the basis of the quantities available and the timescale for their continuing use; and whether the use of recycled HCFCs was sufficient to satisfy needs, especially given that some parties had said that it was not.

147. The Working Group agreed that the contact group would reconvene during the Thirtieth Meeting of the Parties to resume its work on sub-item 7 (b) of the agenda for the present meeting, on proposed adjustments to the Montreal Protocol, and requested the secretariat to prepare, for consideration by the contact group at the Thirtieth Meeting of the Parties, a consolidation of the two adjustment proposals and a summary of the issues discussed by the contact group at the present meeting.

VIII. Consideration of senior expert nominations from parties to the Technology and Economic Assessment Panel (decision XXIX/20)

148. Introducing the item, the Co-Chair recalled decision XXIX/20, in which the Twenty-Ninth Meeting of the Parties had appointed co-chairs of the technical options committees and senior expert members of the Technology and Economic Assessment Panel. The senior experts had been appointed to serve on the Panel for one year, until the end of 2018. In the same decision, the parties had requested the Secretariat to add consideration of the senior expert nominations to the agenda of the current meeting.

149. She suggested that parties refer to the expertise required by the Panel, which was listed in annex 2 to volume 3 of the Panel's 2018 progress report, and to the full list of the members of the Panel, contained in annex 1 to the same report. She also drew attention to the goal, noted in the terms of reference of the Panel, of appointing between two and four senior experts for specific expertise not covered by the co-chairs of the Panel or the technical options committees, taking into account gender and geographical balance.

150. She proposed that parties should not discuss individual nominations, but that those parties interested in nominating senior experts should consult the members of the Panel and the committees and representatives of other parties informally. After consultations at the present meeting, intersessionally and at the Thirtieth Meeting of the Parties, any nominations that parties decided to make should be submitted to the Secretariat as a conference room paper for consideration by the Thirtieth Meeting of the Parties. She then invited parties to make general comments.

151. Representatives agreed that the role of senior experts on the Technology and Economic Assessment Panel was an important one, allowing the Panel access to expertise that it would not otherwise have. It was regrettable, however, that there was currently no balance between senior experts from Article 5 and non-Article 5 parties, which was not in line with the Panel's terms of reference. Some representatives observed that parties needed to be more proactive in proposing nominations in order to ensure that the Panel was able to respond to the requests that parties made of it. One representative, highlighting the need of the Panel for expertise relevant to the implementation of the Kigali Amendment, said that she would welcome any suggestions from the Panel on how to make the process more effective.

152. Following informal consultations, the facilitator - reported that participants had conveyed a number of messages related to the item, including that, as a general principle, the parties should ensure that candidates held the expertise required by the Technology and Economic Assessment Panel and propose and evaluate candidates on that basis and taking into account the principles of gender and regional balance; that new areas of expertise might be needed under the Kigali Amendment so the Panel should adapt to meet those needs, while ensuring continuity of expertise; and that it would be

useful if the Panel presented their needs, as set out in the "matrix of needed expertise" contained in annex 2 to volume 3 of its 2018 progress report, to the parties, and if it played a more active role in identifying possible candidates.

153. The Working Group agreed to defer further consideration of the item to the Thirtieth Meeting of the Parties.

IX. Other matters

A. Global emissions of CFC-11

154. Introducing the sub-item, the Co-Chair recalled that it had been added under agenda item 9, on other matters, at the request of one party. She suggested that the Working Group could invite the Scientific Assessment Panel and the Technology and Economic Assessment Panel to provide background information on the issue of global emissions of CFC-11 in order to facilitate a discussion by the parties.

155. The representative of the European Union explained that he had asked for the sub-item to be included on the agenda of the current meeting in the light of the information provided by the secretariat in document UNEP/OzL.Pro.WG.1/40/INF/2/Add.1, which summarized the findings of a scientific study published in May 2018 in the journal *Nature*. The study, entitled "An unexpected and persistent increase in global emissions of CFC-11", revealed that emissions of CFC-11 had increased in recent years despite the reported elimination of CFC-11 production under the Montreal Protocol. At a side event held the previous day, the United States National Oceanic and Atmospheric Administration (NOAA), whose atmospheric measurements had been used as a basis for the study, had delivered an informative presentation on the study that was available on the meeting portal. Slide 17 of the presentation summarized as the study's key findings that: (a) since 2013, the annual decline in CFC-11 concentration had been only half as fast as that of the previous decade (2002–2012); (b) emissions of CFC-11 had increased after 2012 and had remained elevated every year since then; (c) emissions of CFC-11 from eastern Asia had increased since 2012; (d) the observations suggested unreported production of CFC-11 after the 2010 global phase-out of the substance; and (e) detecting and diagnosing atmospheric composition change required an extensive network of high-quality measurements and accurate and sophisticated modelling tools.

156. Noting that more information had become available since the publication of the study, he suggested that, following an update on the state of play by the relevant Montreal Protocol assessment panels, the parties could pose questions to the panels on the information provided in order to better understand the issue of the CFC-11 emissions. The parties could then hold an open, transparent and inclusive discussion on the possible way forward to address the issue in order to ensure that the emissions did not undermine the efforts undertaken to date under the Montreal Protocol.

157. Mr. Paul Newman, co-chair of the Scientific Assessment Panel, gave a presentation on the study published in *Nature* on behalf of the co-chairs of the Panel and Mr. Stephen Montzka, the main author of the study, noting that the presentation was available on the meeting portal. Drawing attention to the main findings of the study, he said that while the data analysed referred to emissions, not production, of CFC-11, the data suggested that there had been increased production of CFC-11 after the 2010 global phase-out of the substance. In closing, he said that the results of the study would be included in *Scientific Assessment of Ozone Depletion: 2018*, which would be finalized by 31 December 2018 and would include a chapter discussing the implications of CFC-11 emissions for the recovery of the ozone layer. An executive summary of the assessment report would be produced in the following weeks and would be presented for consideration at the Thirtieth Meeting of the Parties. The study in *Nature* had triggered the conduct of additional research, and it was expected that the results of analyses of data being collected at stations in China, Japan and the Republic of Korea would be issued sometime in 2019.

158. Ms. Maranion, co-chair of the Technology and Economic Assessment Panel, presented additional information on CFC-11, stressing that the potential sources of CFC-11 emissions were not currently known and that the Panel had begun to examine that issue. With regard to production, CFC-11 was used primarily as a foam blowing agent for flexible polyurethane insulating foams, as a refrigerant, for centrifugal chillers used in large commercial buildings, and for a range of smaller and less common uses, including as propellants in asthma inhalers and as solvents in manufacturing processes, and in fire extinguishing agents, but commercial affordable alternatives existed for most

uses. CFC-11 production had peaked in the 1980s,[1] when emissions had also peaked at 350 gigagrams (or 350,000 tonnes) per year, and under the Montreal Protocol production of CFC-11 had been phased out in 1996 in non-Article 5 parties and in 2010 in Article 5 parties, but exceptions had been made for small amounts of CFC-11 production for essential uses, such as asthma inhalers. The production of CFC-11 for both feedstock[2] and non-feedstock uses had to be reported under Article 7 of the Montreal Protocol, and no feedstock uses were currently reported by parties..]CFC-11 was produced from hydrofluoric acid and carbon tetrachloride in the liquid phase in the presence of an antimony catalyst. A mix of CFC-11 and CFC-12 was produced, with the proportion of CFC-12 and CFC-11 controlled by varying the operating conditions. 100 per cent CFC-12 was achieved relatively easily; 100 per cent CFC-11 is more difficult to achieve but not impossible in well-operated facilities. An operating range of 30:70, either way, could be achieved comfortably. In well-operated facilities, emissions from production processes were low (average 0.5 per cent).

159. Ms. Maranion said that the study published in *Nature* had found that the increase in CFC-11 emissions appeared to be unrelated to past production of CFC-11, which suggested that there was unreported new production of the substance. CFC-11 was produced as a by-product in the manufacturing of other chemicals, such as HCFC-22, but such production was negligible under normal operating conditions. Its use as a blowing agent in rigid polyurethane foams had largely been replaced with HCFC-141b and, assuming that CFC-11 was used for some rigid polyurethane foam applications with a high emissions rate of 15 per cent during insulation, a supply or the production of approximately 90,000 tonnes per year of CFC-11 would be required to generate emissions of the order of 13,000 tonnes per year. There had been several very serious fires in east Asia some eight years earlier, as a result of which concern arose about whether sufficient fire retardant was used in cyclopentane blown foams. Standards were upgraded and there was a period when very little plastic insulation was allowed in construction. More recently, a number of new patents related to CFC-11 had been published over the past two years. It was not yet known in which jurisdictions those patents had been filed and whether or not any of the products had been commercialized. Past production made its way into global banks in foams and chillers, which were actually emitting CFC-11. Any remaining chemical stockpiles were also gradually leaking CFC-11. Such gradual releases had continued before and after 2012.

160. As for chillers, stockpiles were gradually leaking CFC-11, but the total global bank of CFC-11 in chillers was estimated to be between 3,000 and 4,000 tonnes maximum. The known bank of CFC-11 (estimated total: 1,420,000 tonnes in 2008) was primarily from insulating foams, especially closed-cell polyurethane used in cladding panels for buildings and appliances such as refrigerators. Any additional production of CFC-11 would result in an increased volume of CFC-11 in banks and/or emissions. There were some emissions from the foam bank throughout the useful life and during the disposal process. Emissions from the bank were expected to gradually decrease over time based on the amount of foam blowing agent remaining in the foam. During the foam dismantling and disposal process, there were generally additional emissions from foams. A sudden increase in emissions from foam banks would require sudden destruction of closed foam cells with no abatement of the release. For context, the emission of 13,000 tonnes of CFC-11 per year would require the destruction of 2 million tonnes of foam, which was equivalent to one third of the entire global annual production of polyurethane rigid foam in 2017, including all blowing agents. Similarly, CFC-11 emissions could result from the recovery and recycling of insulating foam panel contents when the CFC-11 blowing agent was allowed to be released, but the release of 13,000 tonnes of CFC-11 emissions every year since 2013 would have required the disposal of 13 million large-sized refrigerators of the type used in the United States or double or quadruple that number if smaller refrigerators, such as those used in Asia and Europe, were disposed of.

161. At the end of life, foams were generally disposed of in landfills, where CFC-11 would slowly emit over time (0.5 per cent per year) excluding any amount that might be bioremediated (chemical breakdown of CFC-11 by bacteria) in the landfill. There was the potential for bioremediation of up to 94 per cent of the blowing agent (i.e., CFC-11) that reached a landfill. Foam bank emissions after the destruction of buildings or appliances would likely occur over time from a landfill. For the observed trends to be related to the foams bank (leakage or disposal), there would need to have been an acceleration of the pre-existing trend after 2012. The Technology and Economic Assessment Panel was not aware whether there were new or unusual emissive uses of CFC-11 that had started or

[1] https://unfccc.int/files/methods/other_methodological_issues/interactions_with_ozone_layer/application/pdf/cfc1100.pdf. Alternative Fluorocarbons Environmental Acceptability Study (AFEAS) reporting did not include sources from Article 5 parties.

[2] Feedstock uses refer to the use of ozone-depleting substances as chemical building blocks for the commercial synthesis of other chemicals.

accelerated after 2012. There were a number of possible practical uses for CFC-11, for example as a foam-blowing agent, a refrigerant or as a quick evaporating solvent.

162. Following the presentations, representatives thanked the members of the Scientific Assessment Panel and the Technology and Economic Assessment Panel for the information provided and for their hard work.

163. Responding to specific questions on his presentation, Mr. Newman explained that the observed increase in CFC-11 emissions could not be the result of natural phenomena because CFC-11 was a man-made gas that did not occur naturally, and that global warming could produce changes in the circulation of CFC-11 in the stratosphere, but such changes would not substantially affect global emissions estimates, given that CFC-11 had a lifetime of between 52 and 57 years. With regard to the difference between the two CFC-11 global annual emissions estimates provided in the study, he explained that the estimate of 13 gigagrams corresponded to the increase in average annual emissions observed, assuming a constant atmospheric lifetime for CFC-11, whereas the estimate of 25–30 gigagrams of CFC-11 emissions above expected levels was based on the assumption that, as CFC-11 banks decreased over time, a corresponding decrease in emissions should also be observed.

164. As for questions regarding the quantity, duration and nature of CFC-11 production that might have led to the increased emissions observed, Mr. Newman said that atmospheric observations merely showed that CFC-11 emissions had increased by 13 gigagrams per year, but that they could not explain what the production of CFC-11 had been. On a related question about whether other chemicals might help to identify the source of CFC-11 emissions, he said that chemical fingerprints such as HCFC-22, dichloromethane and carbon monoxide in air samples had enabled scientists to link observed increases of CFC-11 to actual emissions and to pinpoint eastern Asia as the source of such emissions. Noting that it would be desirable to have a chemical footprint associated with a particular sector to determine the potential sources of emissions, he said that the Scientific Assessment Panel had not examined that issue in detail but would do so in moving forward.

165. In relation to the expected impact of the increase of CFC-11 emissions on the recovery of the ozone layer, Mr. Newman said that preliminary calculations showed that sustained emission increase of CFC-11 of 13 +/- 5 gigagrams per year indefinitely into the future would delay the global recovery of the ozone layer by about nine years and the recovery of the ozone hole by 30 years. In response to another question, he explained that the impact of increased CFC-11 emissions would take about five years to appear in Antarctica, but that given that the lifetime of CFC-11 exceeded 50 years, the problem would persist for at least some 50 years after the emissions occurred.

166. In response to a question on why the parties to the Montreal Protocol had not been informed earlier of the observed increases in CFC-11 emissions, Mr. Montzka explained that scientists had first observed an increase in emissions in 2014, but had needed time to assess and interpret the data obtained through measurements and to translate it into information that was useful to policymakers.

167. With regard to historical applications of CFC-11, Ms. Maranion said that it had primarily been used as a blowing agent in foams and as a refrigerant, as well as in a range of smaller uses such as asthma inhalers. Regarding recent CFC-11 patent applications, she said that the patents referred to the spraying of CFC-11 in foams to reduce their flammability, as well as new technologies, but that the status of the patents was unclear in terms of the commercialization of the uses proposed. With regard to questions raised regarding the possible sources of CFC-11 emissions, she said that it was possible that they corresponded to the use of CFC-11 in foams and in refrigerant insulation panels, but that the Technology and Economic Assessment Panel would need to gather more information in order to be able to identify the potential sources of the increased emissions.

168. In the ensuing discussion, general appreciation was expressed to the Scientific Assessment Panel and the Technology and Economic Assessment Panel for clear, comprehensive and informative presentations, which had been prepared at very short notice and which, according to several representatives, including one speaking on behalf of a group of parties, had been effective in conveying the scale and difficulties of the issues. The representative speaking on behalf of a group of parties, supported by another, said that it was important to consider how the information could best be captured and used at the present and subsequent meetings. Most of those who spoke called for further investigations, which, according to some, should be fully transparent and unbiased. Many representatives agreed that the reported increase in global emissions of CFC-11 was a matter for serious concern and that the international community must take decisive, collective action under Montreal Protocol to address it, backed by sustainable, long-term solutions, in order to prevent any recurrence. One stressed that it was important to proceed with caution, not to rush to conclusions and, as in the past under the Protocol, to ensure that any action taken was based on robust scientific and technical data and information. Another representative, noting that the Scientific Assessment Panel

had, as described in its presentation, observed a potential problem of increased global emissions of CFC-11 sometime previously, said that if the Panel had informed the parties earlier they would already be taking action to address it.

169. Many representatives, including several speaking on behalf of low-volume-consuming Article 5 parties that had been striving to eliminate and prevent the use of banned substances to ensure compliance with their obligations under the Montreal Protocol, said that the reported increase in global emissions of CFC-11 was alarming and threatened to undermine the reputation and continued success of the Protocol. One representative, supported by another, expressed the view that the identification of the problem showed the importance of maintaining high-quality scientific surveillance of ozone-depleting substances and atmospheric emissions, pointing out that the necessary mechanisms were in place to undertake more detailed analysis to better understand the data. He added that all parties should strive to ensure that they were meeting their obligations. One representative said that it was important for those closest to the source of the problem, in particular, to be involved in keeping track of and addressing further developments. Another appealed to those responsible for the increase to stop, while the representative of Japan said that his Government, which had provided significant funding for the phase-out of ozone-depleting substances, would find it hard to justify to taxpayers the continued provision of full-scale funding if the reported increase in CFC-11 production proved to be occurring and was not addressed, thereby undermining the credibility of the Montreal Protocol. The parties must cooperate constructively to assess the situation and take appropriate action based on the facts.

170. Several representatives suggested a number of preliminary steps to take at the current meeting and in the months leading up to the Thirtieth Meeting of the Parties. One representative, speaking on behalf of a group of parties and supported by several others, said that the Technology and Economic Assessment Panel should be requested to prepare a concise policy brief for the upcoming Thirtieth Meeting of the Parties that would keep parties up to date on the matter, make clear to Governments the significance of the issues and demonstrate that the parties to the Montreal Protocol were taking prompt action to address them. Several representatives expressed a willingness to work with others to formulate that request. One representative said that the Scientific Assessment Panel should investigate the reported increase in emissions and report back to the parties on the geographic sources and potential impacts as soon as possible, adding that it was important to determine whether the emissions came from new production, from the existing CFC bank or from any of the theoretical sources highlighted in the presentation. One representative, supported by another, said that the assessment panels should also be requested to provide a country-by-country estimate of obsolete CFC stocks, in particular CFC-11, and how they were being stored, to which end he recommended that parties be encouraged to report the data on their respective stocks to the Secretariat. Another representative said that it was important to find out whether there were any increases in emissions of other banned substances. One representative, supported by several others, called for the establishment of mechanisms to assist Article 5 parties in the monitoring and control of such ozone-depleting substances in order to ensure their continued phase-out. One representative, speaking on behalf of a group of parties and supported by another, suggested that a summary of the Technology and Economic Assessment Panel's presentation should be included in the report of the meeting. Another representative said that a discussion of the issue of increased global emissions of CFC-11 should be included as a separate item, rather than under "other matters", on the agenda of the Thirtieth Meeting of the Parties.

171. Many representatives, including one speaking on behalf of a group of parties, expressed an interest in holding further discussions with other parties and the assessment panels in a contact group to determine the appropriate way forward.

172. One representative said that his delegation was working with others on a conference room paper to request those with the relevant expertise and information to share it with the Working Group, either in plenary or in the margins of the meeting, so as to allow participants to bring their countries up to date on the actual state of affairs. It would be helpful, he added, if the Secretariat produced a paper summarizing the facts as they stood to serve as a basis for the discussion.

173. The representative of an observer organization that had investigated the reported increase in CFC-11 emissions said that it had obtained evidence that the substance was being used in the rigid polyurethane foam insulation sector, particularly in the building and construction subsector, and that emissions from that sector could account for a significant share of the reported increase. A comprehensive approach was required to tackle the issue, including by examining the drivers of the production and use of CFC-11.

174. Subsequently, the representative of the United States of America introduced a conference room paper, containing a draft decision, on behalf of a group of parties.

175. The Working Group agreed to establish a contact group to discuss the draft decision.

176. Accordingly, the Working Group established a contact group, co-chaired by Ms. Annie Gabriel (Australia) and Mr. Agustín Sánchez Guevara (Mexico), to consider the clarifications provided by the assessment panels of the information provided in their presentations; to consider and finalize for possible adoption by the Open-ended Working Group the draft decision set out in the conference room paper submitted by the United States; to discuss the issues to be addressed and action to be taken in the period before the Thirtieth Meeting of the Parties; and to address the recent press reports on the global CFC-11 emissions.

177. Subsequently, the representative of China made a statement denouncing the distribution at the meeting of a report by the Environmental Investigation Agency in which 18 companies in China's foam-blowing industry were accused of involvement in the large-scale illegal sale and use of CFC-11. His Government had launched an investigation the previous month, immediately after receiving a copy of the report from the Agency, and had found no evidence to support the allegations at any of the nine companies inspected to date. The report, in sharp contrast to the *Nature* article that had sparked the current discussion, was based on uncorroborated data obtained from unreliable sources, through social media; it impugned the reputation of his country's foam-blowing industry and undermined the prospects for goodwill and the involvement of non-governmental organizations in the dialogue needed to address the issue. Endorsing the conference room paper as a sound basis for further discussion at the Thirtieth Meeting of the Parties, in which his country was ready to actively participate, he called on all parties to work together in a calm, scientific and mutually respectful manner, urging them to condemn the unprecedented publication of baseless accusations against a fellow party, which was a threat to the credibility of the Protocol.

178. In the ensuing discussion, one representative said that all non-governmental organizations had a right to provide information to the parties but that it was unacceptable to level such accusations, adding that the parties, for their part, must base conclusions exclusively on scientifically verified official data.

179. Another representative, expressing appreciation to the Government of China for its swift response to the Environmental Investigation Agency report and requesting a bilateral meeting to discuss its lack of evidence of large-scale illegal activities, urged that party to widen its investigation to the production and use of CFC-11 in the entire foam-blowing sector and to share its initial findings with the Secretariat. The increase in global CFC-11 emissions was a problem of such importance to the continued success of the Protocol and its institutions that any independent public body with information on possible violations, regardless of how it had been gathered, must be permitted to bring it to the attention of the parties so that it could be assessed by scientists. The countries with monitoring stations closest to the source should also share their data in a transparent and timely manner so as to enable the parties to come to grips with the problem and take strong, collective action to halt any wrongdoing.

180. The representative of China, responding to the comments, said that the investigations under way in his country were already sector-wide in scope and that his Government would continue to apply a zero-tolerance approach when dealing with any cases of non-compliance detected, adding that his Government would continue to enforce the country's strict laws, with a zero tolerance approach towards – and severe punishments for – offenders, should any cases of non-compliance be detected.

181. Following the contact group discussions, the co-chair of the contact group reported that the group had reached agreement on a revised version of the draft decision. She said that the contact group had further agreed to encourage the parties and relevant institutions to take action on CFC-11 in the lead-up to the Thirtieth Meeting of the Parties. In particular, the group had requested the Scientific Assessment Panel and the Technology and Economic Assessment Panel to provide additional information to the Thirtieth Meeting of the Parties, to the extent possible and within their existing mandates, on CFC-11 emissions; the secretariat to prepare a document summarizing any new scientific or technical information on CFC-11; and parties and scientific institutions to make available any monitoring data related to CFC-11. She asked that those requests be included in the present report.

182. One representative asking that her statement be reflected in the present report, expressed a strong interest in dealing with the challenge of CFC-11 emissions in a collaborative manner and in discussing opportunities to strengthen the Montreal Protocol by strengthening the capacities of the parties, including with regard to monitoring, reporting and verification to ensure compliance with the Protocol.

183. The representative of Japan said that the meteorological agency of Japan was monitoring the condition of the atmosphere and would gladly share the data obtained with the parties to the Montreal Protocol, expressing the hope that such information sharing would contribute to fact-finding efforts. He suggested that there could be value in developing a regional monitoring system in East Asia and, at a later stage, a global monitoring system by connecting existing monitoring sites in different parties. In closing, he said that, going forward, the parties might also want to reach out to the Ozone Research Managers of the Parties to the Vienna Convention, which shared information about the condition of the ozone layer and ozone-depleting substances, including CFCs.

184. The Working Group agreed to forward the draft decision, as set out in section A of annex I to the present report, to the Thirtieth Meeting of the Parties for consideration.

B. Review of the composition and organization of the assessment panels

185. Introducing the item, the representative of Saudi Arabia explained that he was seeking a review by the parties of the terms of reference of the Scientific Assessment Panel, the Environmental Effects Assessment Panel and the Technology and Economic Assessment Panel, and their composition and balance, in the light of the challenges to be faced in implementing the Kigali Amendment. That implementation would introduce a range of important issues to parties' deliberations, such as climate change, HFCs, energy efficiency and the conditions in high-ambient-temperature countries, and it was important that the panels have access to appropriate expertise, while not duplicating the work of other United Nations entities, such as the Intergovernmental Panel on Climate Change.

186. It was particularly important that all the panels contain a balance of members from different regions and backgrounds. For example, it had become clear during the discussions on the Kigali Amendment that many people lacked a sufficient understanding of the situation faced by high-ambient-temperature countries. It was also important to avoid domination of the panels by members from non-Article 5 parties; in general there was a lack of experts from Article 5 parties. In conclusion, he announced that his delegation and others were engaged in drawing up a draft decision for consideration by the Working Group.

187. One representative, agreeing that it was right that parties should review and if necessary change their procedures in the light of changing circumstances, nevertheless recalled that a comprehensive and time-consuming review of the Technology and Economic Assessment Panel's terms of reference had been undertaken six years earlier. He suggested that it might be possible to address the concerns raised by the representative of Saudi Arabia through a less lengthy process, such as revising the matrix listing the expertise needed by the Panel.

188. Subsequently, the representative of Saudi Arabia, on behalf of a group of parties, introduced a conference room paper containing a draft decision relating to the sub-item.

189. The Working Group agreed to forward the draft decision, as set out in section C of annex I to the present report, to the Thirtieth Meeting of the Parties for consideration.

C. Eligibility for financial and technical assistance

190. The representative of the United Arab Emirates underscored the support his country had provided to the Montreal Protocol since its inception and the fact that it had always been in compliance with its obligations under the Protocol. It had, for example, hosted the Twenty-Seventh Meeting of the Parties and facilitated the conclusion of the Dubai pathway on hydrofluorocarbons. It was cooperating with various organizations on a variety of topics related to ozone-depleting substances and HFCs, had hosted several other relevant meetings, including of the West Asia ozone officers' network, and was planning a series of forums on the development of alternative refrigeration technology in countries with high ambient temperatures. All that had been done without any financial assistance from the Multilateral Fund.

191. The new set of commitments stemming from the Kigali Amendment would be challenging for Article 5 parties, especially in relation to the overlap of the implementation of their HCFC and HFC obligations, and particularly for countries with high ambient temperatures. He was therefore requesting that the parties consider the eligibility of the United Arab Emirates for financial and technical assistance to meet its obligations under the Montreal Protocol.

192. All the representatives who spoke, whether or not they supported the proposal, acknowledged the contribution made to the Montreal Protocol by the United Arab Emirates and its achievements in relation to the Protocol.

193. One representative, who recalled that the issue of the eligibility of the United Arab Emirates had long been discussed and had originally been foreseen in the provisional agenda of the thirty-ninth

meeting of the Open-ended Working Group, sought to clarify that the mandate for the agenda item was to resume previous talks focusing on the specific issue related to the United Arab Emirates. The co-chair confirmed that understanding.

194. However, a few representatives stated that the issue of eligibility should be considered more broadly, as originally mandated under agenda item 2 (a), and subsequently intervened on that basis.

195. One representative said that certain elements relating to the implementation of the Kigali Amendment were still to be defined and it was inopportune to take a decision with regard to a single party and at the present time.

196. Although several representatives stressed their conviction that the United Arab Emirates had the same rights as other Article 5 parties, one outlined what he understood to be the history of the classification of the country as an Article 5 party. He said that the United Arab Emirates had first been an Article 5 party, and had then briefly been reclassified as a non-Article 5 party, finally being classified again as an Article 5 party through a decision of the Implementation Committee rather than the Meeting of the Parties. At that time, the United Arab Emirates had been urged not to seek assistance from the Multilateral Fund for its national programmes. The same representative noted that there were other Article 5 parties that had also never received financial assistance from the Fund.

197. One representative noted that, while the decision of the Implementation Committee had applied to the implementation of activities to phase out ozone-depleting substances, both the situation in the United Arab Emirates and the nature of the obligations had changed since that time. The Kigali Amendment dealt with HFCs and global warming.

198. In response, another representative said that the aforementioned compromise reached at the time of adoption of the decision by the Implementation Committee remained valid. In return for being classified as an Article 5 party, which allowed the United Arab Emirates to avail itself of Article 5 phase-out and phase-down schedules, and to be exempt from making contributions to the Multilateral Fund, the country should not be eligible for financial support from the Fund. The representative considered it inappropriate to request that money from his country's taxpayers be channelled to a country where the income per capita was higher than in his own country. He noted that, were a contact group to be established on the matter, its mandate should consider the issue of eligibility for funding more broadly and not only in relation to the United Arab Emirates. The co-chair confirmed that understanding.[1]

199. Another representative stressed the need to find a way forward that suited every party.

200. The Working Group agreed that the United Arab Emirates would continue bilateral consultations in the margins of the meeting and that the issue would be taken up at the Thirtieth Meeting of the Parties.

D. Invitation by Ecuador to the Thirtieth Meeting of the Parties

201. Mr. Carlos Alberto Játiva Naranjo, Ambassador of Ecuador to Austria, extended an invitation to all the participants to attend the Thirtieth Meeting of the Parties in Quito from 5 to 9 November 2018, pointing out that it was the first time that a Meeting of the Parties to the Montreal Protocol would be held in a South American country. He then introduced a short video film highlighting the beauty and charms of Quito city.

X. Adoption of the report

202. The parties adopted the present report on Saturday, 14 July 2018, on the basis of the draft report set out in document UNEP/OzL.Pro.WG.1/40/L.1. The Ozone Secretariat was entrusted with the finalization of the report.

203. At the time of the adoption of the report, one representative requested consistency in attributing statements to specific parties using country names in the reports of meetings.

XI. Closure of the meeting

204. Following the customary exchange of courtesies, the fortieth meeting of the Open-ended Working Group of the Parties to the Montreal Protocol was declared closed at 10.45 p.m. on Saturday, 14 July 2018.

[1] This sentence was agreed upon during the adoption of the report.

Annex I

Draft decisions

The Working Group agreed to forward to the Thirtieth Meeting of the Parties, the following draft decisions for further consideration, on the understanding that they did not constitute agreed text and were subject in their entirety to further negotiation.

The Thirtieth Meeting of the Parties decides:

A. Unexpected emissions of trichlorofluoromethane (CFC-11)

Submission by the contact group on CFC-11 emissions

Noting the recent scientific findings showing that there has been an unexpected increase in global emissions of trichlorofluoromethane (CFC-11) since 2012, after the consumption and production phase-out date established under the Montreal Protocol,

Appreciating the efforts of the scientific community in providing that information,

Expressing serious concern about the substantial volume of unexpected emissions of CFC-11 in recent years,

1. To request the Scientific Assessment Panel to provide to the parties a summary report on the unexpected increase of CFC-11 emissions, which would supplement the information in the quadrennial assessment, including additional information regarding atmospheric monitoring and modelling, including underlying assumptions, with respect to such emissions; a preliminary summary report should be provided to the Open-ended Working Group at its forty-first meeting, a further update to the Thirty-First Meeting of the Parties and a final report to the Thirty-Second Meeting of the Parties;

2. To request the Technology and Economic Assessment Panel to provide the parties with information on potential sources of emissions of CFC-11 and related controlled substances from potential production and uses, as well as from banks, that may have resulted in emissions of CFC-11 in unexpected quantities in the relevant regions; a preliminary report should be provided to the Open-ended Working Group at its forty-first meeting and a final report to the Thirty-First Meeting of the Parties;

3. To request parties with any relevant scientific and technical information that may help inform the Scientific Assessment Panel and Technology and Economic Assessment Panel reports described in paragraphs 1 and 2 above to provide that information to the Secretariat by 1 March 2019;

4. To encourage parties, as appropriate and as feasible, to support scientific efforts, including for atmospheric measurements, to further study the unexpected emissions of CFC-11 in recent years;

5. To encourage relevant scientific and atmospheric organizations and institutions to further study and elaborate the current findings related to CFC-11 emissions as relevant and appropriate to their mandate, with a view to contributing to the assessment described in paragraph 1 above;

6. To request the Secretariat, in consultation with the secretariat of the Multilateral Fund for the Implementation of the Montreal Protocol, to provide the parties with an overview outlining the procedures under the Protocol and the Fund with reference to controlled substances by which the parties review and ensure continuing compliance with Protocol obligations and with the terms of agreements under the Fund, including with regard to monitoring, reporting, and verification; to provide a report to the Open-ended Working Group at its forty-first meeting and a final report to the Thirty-First Meeting of the Parties;

7. To request all parties:

(a) To take appropriate measures to ensure that the phase-out of CFC-11 is effectively sustained and enforced in accordance with obligations under the Protocol;

(b) To inform the Secretariat about any potential deviations from compliance that could contribute to the unexpected increase in CFC-11 emissions.

B. Access of parties operating under paragraph 1 of Article 5 of the Montreal Protocol to energy-efficient technologies in the refrigeration, air-conditioning and heat-pump sectors

Submission by Rwanda on behalf of the African Group

Noting the imminent entry into force of the Kigali Amendment to the Montreal Protocol,

Recognizing the role of all United Nations bodies in supporting the global response to the threat of climate change and its increasing impacts worldwide,

Acknowledging that the effective implementation of the Kigali Amendment will require additional efforts to reduce greenhouse gases and will give rise to the opportunity to address energy efficiency concerns and contribute to the reduction of indirect emissions of greenhouse gases,

Cognizant that developing countries face the challenge posed by the pervasive entrance of inefficient, outdated and/or obsolete technologies into their markets,

Recognizing the opportunities cited by the Technology and Economic Assessment Panel in volume 5 of its May 2018 report, where it is noted that several categories of enabling activities can potentially serve to bridge activities related to enhancing or maintaining energy efficiency with hydrofluorocarbon phase-down activities,

1. To request financial support for parties operating under paragraph 1 of Article 5 for the development and enforcement of policies and regulations to avoid the assembling and manufacturing of energy-inefficient refrigeration, air-conditioning and heat pump equipment as well as its import and penetration into their markets;

2. To request the Meeting of the Parties to approve a window for funding demonstration projects in parties operating under paragraph 1 of Article 5 that can provide information on costs and cost-effectiveness as well as practical experience to inform discussions and decisions on maintaining energy efficiency in the servicing sector;

3. To request the Executive Committee of the Multilateral Fund to develop guidelines for bulk procurement processes that will allow aggregation of demands for equipment with high energy efficiency and lower global warming potential at affordable prices;

4. To request the Technology and Economic Assessment Panel to include in its annual reports updates on the cost and availability of lower-global-warming-potential refrigerants and energy-efficient equipment applicable to all, including high-ambient-temperature countries;

5. To request implementing agencies to facilitate the provision of targeted training on certification, safety and standards, awareness-raising and capacity-building that will assist parties operating under paragraph 1 of Article 5 in maintaining and enhancing the energy efficiency of refrigeration, air-conditioning and heat-pump equipment.

C. Review of the terms of reference, composition and balance as well as fields of expertise required of the assessment panels and their subsidiary bodies

Submission by Bahrain, Egypt, India, Iraq, Jordan, Kuwait, Oman, Rwanda, Saudi Arabia, Tunisia and United Arab Emirates

Recalling decision VIII/19, in which the terms of reference of the Technology and Economic Assessment Panel were adopted as set out in annex V of the report of the Eighth Meeting of the Parties, and decision XXIV/8, in which the terms of reference were revised,

Noting that the Technology and Economic Assessment Panel and the technical options committees, through provision of independent technical and scientific assessments and information, have helped the parties reach informed decisions,

Recalling paragraph 5 (e) of decision VII/34, on the organization and functioning of the Technology and Economic Assessment Panel and specifically on efforts to increase the participation of experts from parties operating under paragraph 1 of Article 5 in order to improve geographical expertise and balance,

Recalling also decision XXVIII/2, by which the Twenty-Eighth Meeting of the Parties adopted the amendment to the Montreal Protocol, leading to the phase-out of high-global-warming-potential hydrofluorocarbons, which are greenhouse gases leading to new challenges,

Recalling further decision XXVIII/3, in which the Twenty-Eighth Meeting of the Parties recognized that a phase-down of hydrofluorocarbons under the Montreal Protocol would present additional opportunities to catalyse and secure improvements in the energy efficiency of appliances and equipment,

Recognizing the importance of maintaining and/or enhancing energy efficiency while transitioning away from high-global-warming-potential hydrofluorocarbons to low-global-warming-potential alternatives in the refrigeration, air-conditioning and heat pump sectors,

1. To request the Ozone Secretariat to prepare a document, for the Open-ended Working Group at its forty-first meeting, on the assessment panels and their subsidiary bodies in view of changing circumstances, including the Kigali Amendment, including the following:

(a) Terms of reference, composition, and balance with regard to geography, representation of parties operating under paragraph 1 of Article 5 and parties not so operating, and gender;

(b) The fields of expertise required for the upcoming challenges related to implementation of the Kigali Amendment, such as energy efficiency, climate benefits, safety, etc.;

2. To invite the parties to provide their inputs to the Secretariat so that it can prepare the document for the consideration of the Open-ended Working Group at its forty-first meeting so that a decision regarding the document can be taken at the Thirty-First Meeting of the Parties.

Annex II

Summaries of presentations by the members of the Technology and Economic Assessment Panel

A. Report of the decision XXIX/4 task force on destruction technologies for controlled substances

1. Ms. Helen Tope, co-chair of the Technology and Economic Assessment Panel's task force on destruction technologies, introduced the Panel's response to decision XXIX/4 on destruction technologies for controlled substances. She recalled that, in decision XXIX/4, the parties had requested the Panel to undertake an assessment of destruction technologies approved under decision XXIII/12 with a view to confirming their applicability to HFCs, and a review of any other technology for possible inclusion in the list of approved destruction technologies in relation to all controlled substances. She reported that the Panel had formed a task force in response to the decision and that 10 parties had submitted information in accordance with the decision. She indicated that the task force had also conducted literature research, reviewed other publicly available information, and requested additional information and detailed clarifications from parties and technology suppliers and owners. The task force had submitted its first report in early April and determined that it was necessary to prepare and submit a supplemental report to the Open-ended Working Group at its fortieth meeting, as provided for in the decision.

2. Providing background information, she summarized a number of obligations under the Montreal Protocol and its Kigali Amendment that required controlled substances to be destroyed by technologies approved by the parties. She highlighted that parties had adopted decisions requesting the Technology and Economic Assessment Panel to assess, and parties to approve, destruction technologies since the First Meeting of the Parties, with a list of approved destruction technologies updated by the parties in progressive decisions, most recently in an annex to decision XXIII/12. The current assessment built on previous assessments by the Panel and its subsidiary bodies, including a number of reports, since 2002. In 2002, the Panel had developed screening criteria for the assessment of destruction technologies and presented those criteria. One criterion, namely destruction and removal efficiency, was calculated by subtracting the mass of the chemical released in stack gases from the original amount fed into the system. Other criteria were relevant to emissions of dioxins and furans, acid gases, particulates, carbon monoxide and the processing capacity of the technology. Those criteria had been used as the basis for the Panel's assessments of destruction technologies since 2002, and the same criteria had also used been used as the basis for the most recent assessment in order to ensure internal consistency. She noted that costs and economic feasibility had not been considered in the assessment. She restated, as described in the 2002 Technology and Economic Assessment Panel task force report, that those criteria represented the minimum destruction and removal efficiencies and maximum permitted emissions of pollutants to the atmosphere by technologies that qualified for consideration for recommendation for approval as ozone-depleting substance destruction technologies. She also noted that the 2002 task force had advised that the criteria were determined to represent a reasonable compromise between more stringent standards already in place and less stringent or non-existent standards. She noted that the assessment criteria served as a benchmark for comparison purposes, that they were not intended to imply a level of standards for pollutants emitted from destruction technologies, and that those were matters for operators and Governments to consider within national regulatory frameworks. She introduced the task force's approach to its assessment of destruction technologies for their applicability to HFC destruction, noting that the same performance criteria had been used for destruction and removal efficiency, hydrogen fluoride and carbon monoxide gases, and technical capacity.

3. Ms. Helen Walter-Terrinoni, co-chair of the Panel's task force on destruction technologies, expanded on the destruction assessment criteria used by the task force, noting that incineration and plasma arc destruction technologies that had met the criterion for particulates and dioxins and furans were considered capable of meeting the same performance criterion during the destruction of HFCs. She said that particulate levels were unlikely to differ greatly from levels formed during the destruction of ozone-depleting substances and that fluorinated dioxins and furans were more difficult to form than those chlorinated species under the same operating conditions. She noted that as HFC-23 (Annex F, Group 2) had higher thermal stability than the HFCs in Annex F, Group 1, technologies that were able to satisfy the criteria during the destruction of HFC-23 could also be recommended for approval for the destruction of all HFCs from Annex F, Group 1. However, technologies that had demonstrated the ability to satisfy the criteria for HFCs from Annex F, Group 1, could not necessarily

be recommended for the destruction of HFC-23 due to its relatively higher thermal stability. Owing to the unique and varied methods involved in conversion technologies, each technology was required to demonstrate that it could meet all the performance criteria when used for HFC destruction. Other considerations described included the need for appropriate precautions to be taken by operators in the destruction of flammable refrigerants. The 2018 assessment of the task force on destruction technologies assessed destruction and removal efficiency and did not consider losses during the use or collection of halocarbons in its analysis of destruction technologies, including for HFC-23 or methyl bromide destruction technologies. Finally, owing to the nature of conversion technologies and reactor cracking, particulate emissions could be reduced and might meet the particulate performance criterion for HFC destruction if oil contaminants had been removed. She then described the assessment criteria for methyl bromide, noting that although destruction had been reported, no destruction technology had yet been approved by the parties for methyl bromide. The 2018 assessment concluded that for methyl bromide, as for concentrated sources of other ozone-depleting substances and HFCs, the destruction and removal efficiency of the destruction step alone should be > 99.99 per cent to minimize emissions. The 2018 assessment did not attempt to quantify the efficiency of the fumigation and extraction steps, or any associated fugitive emissions, of the only process assessed.

4. Ms. Walter-Terrinoni then discussed the basis for recommendations made by the 2018 task force on destruction technologies. Technologies were recommended for approval for the destruction of ozone-depleting substances if they were demonstrated to have destroyed ozone-depleting substances to the technical performance criteria, on at least a pilot scale or demonstration scale, as they had been by the 2002 Technology and Economic Assessment Panel task force on destruction technologies when they were described as screened-in technologies. Technologies were recommended for approval for the destruction of HFCs if they were an approved thermal oxidation or plasma arc destruction technology for ozone-depleting substances, which had demonstrated that it met the particulates and dioxins/furans emissions criteria for ozone-depleting substance destruction, and had been demonstrated to have destroyed HFCs to the technical performance criteria for destruction and removal efficiency, hydrogen fluoride and carbon monoxide, on at least a pilot scale or demonstration scale; or it was an approved conversion (or non-incineration) technology for ozone-depleting substances, or a destruction technology specifically developed for HFCs, that had been demonstrated to have destroyed HFCs to the technical performance criteria for destruction and removal efficiency, hydrogen fluoride, carbon monoxide, particulates, and dioxins/furans, on at least a pilot scale or demonstration scale. Technologies were recommended as having high potential for the destruction of ozone-depleting substances if they had been demonstrated to have destroyed a refractory chlorinated organic compound other than an ozone-depleting substance, to the technical performance criteria, on at least a pilot scale or demonstration scale, which indicated that the technology was considered to have a high potential for application with ozone-depleting substances but had not actually been demonstrated with ozone-depleting substances, which was again consistent with the process of the 2002 task force on destruction technologies. Technologies were recommended as having high potential for the destruction of HFCs if they were an approved destruction technology (including for conversion technology) for ozone-depleting substances but had not actually been demonstrated to have destroyed HFCs to the technical performance criteria, on at least a pilot scale or demonstration scale; or they had been demonstrated to have destroyed a refractory halogenated organic compound, in gaseous or liquid form, other than an ozone-depleting substance or HFCs, to the technical performance criteria, on at least a pilot scale or demonstration scale, but had not actually been demonstrated with HFCs.

5. Technologies were simply described by the task force on destruction technologies if insufficient data was available to assess the destruction technology against the performance criteria as there was a lack of evidence of technical capability.

6. She then summarized additional considerations that the parties may wish to take into account when approving destruction technologies, noting that the 2018 task force had taken an objective approach to its assessment to ensure internal consistency with previous assessments and that although the task force had carried out comprehensive data compilation, in some cases data was not available for assessment. Examples included that some technologies were used to destroy mixed waste streams; emissions data specific to HFCs destruction might not be available for those technologies; emissions testing of destruction technologies might be performed only on surrogate chemicals or surrogate criteria, followed by continuous monitoring of operating conditions to meet local requirements (e.g., measuring opacity as an indicator of particulate levels); some previously approved ozone-depleting substance destruction technologies were no longer in operation, and data on HFC destruction was not available; and in some circumstances, emissions testing had not been feasible. Regarding methyl bromide destruction, she noted that the analysis of brominated and mixed chlorinated/brominated dioxins/furans would be appropriate due diligence under circumstances where they might be formed and might be mandatory under local requirements and that the analysis of

brominated dioxins/furans was technically specialized, costly, and not widely available. She reiterated that parties might wish to consider those factors when deciding whether to approve technologies, or not, based on the balance of available information. Lastly, she reviewed the recommendations made by the task force with a focus on the technologies recommended as having high potential, noting some specific details for those technologies as follows. Cement kilns lacked hydrofluoric acid data, and the data provided on carbon monoxide and particulate emissions did not meet the performance criteria; however, it was noted that when equipped with suitable air pollution control, technology would probably be capable of meeting the performance criteria. The task force had received information about refractory compounds with higher thermal stability than HFCs for rotary kilns. No particulate data was available for superheated steam reactors and reactor cracking but they did not use carbon-based fuels and, therefore, might not have particulates if oils were removed from HFCs prior to destruction.

B. Progress reports on the Technology and Economic Assessment Panel 2018 report, including related issues, by the Panel and the technical options committees

1. Technology and Economic Assessment Panel 2018 progress report

7. Mr. Ashley Woodcock, co-chair of the Technology and Economic Assessment Panel introduced the presentation, describing the large workload required for the drafting of the five volumes of the report that had been completed in 2018, together with their timelines:

- **Volume 1:** TEAP decision XXIX/9 working group report on hydrochlorofluorocarbons and decision XXVII/5 – March 2018
- **Volume 2:** Supplement to the April 2018 decision XXIX/4 TEAP task force report on destruction technologies for controlled substances – May 2018
- **Volume 3:** TEAP 2018 Progress Report – May 2018
- **Volume 4:** Interim report on evaluation of 2018 critical-use nominations for methyl bromide and related matters – May 2018
- **Volume 5:** Decision XXIX/10 task force report on issues related to energy efficiency while phasing down hydrofluorocarbons – May 2018

8. He then listed the 20 Panel members, noting that they were equally divided between Article 5 (10) and non-Article 5 parties (10), and gratefully acknowledged the work of nearly 150 experts from around the world who served on the Panel, its technical options committees and task forces.

9. The co-chair then presented the outline of the presentation to follow: progress reports from each of the technical options committees, followed by the interim critical-use nominations report; and, to finalize, a brief discussion on Technology and Economic Assessment Panel organizational matters

2. Foams Technical Options Committee

10. The co-chair of the Foams Technical Options Committee, Ms. Walter-Terrinoni, reported on the continued growth in the use of foams of approximately 4 per cent per year, noting that insulation for buildings and the cold chain (e.g., refrigerated storage and transportation of food) had the potential to notably reduce the energy load both for heating and cooling. She reported that significant improvements had been made in the development and availability of additives, co-blowing agents, equipment and formulations enabling the successful commercialization of foams containing zero-ozone depletion potential (ODP)/low-global-warming-potential (GWP) blowing agents. Significant conversions were under way in Europe and other non-Article 5 parties, especially for parties with F-gas regulations which had accelerated conversions, while in Article 5 parties, HCFC phase-out management plans (HPMPs) continued to drive transitions in foams.

11. Challenges faced by Article 5 parties were then discussed, including the need for enhanced communication between regulators, producers and users to facilitate product availability and subsequently transition. That matter would be discussed in more detail in the forthcoming quadrennial assessment report. In addition, in some countries, the cost of HCFCs was currently about one third of that of hydroflouroolefins (HFO)/hydrochlorofluoroolefins (HCFOs) and HFCs. Up to 30 per cent of transition decisions in some countries and segments (e.g., spray foam and extruded polystyrene) might be delayed because cost optimization was still under way. Lastly, Ms. Walter-Terrinoni noted that in some Article 5 parties, the import of HCFC-141b was controlled or under license, but polyols containing HCFC-141b could be imported without controls. To counter that, some Article 5 parties were implementing regulations to ban or restrict the import of HCFC-containing polyol systems.

3. Halons Technical Options Committee

12. The co-chair of the Halons Technical Options Committee, Mr. Adam Chattaway, presented the committee's progress report, consisting of an explanation of the terminology used in the committee's and the Technology and Economic Assessment Panel's reports. He explained that the terms "fire protection", "fire suppression" and "fire extinguishing" could have different meanings in the wider context of the fire industry in general, but were considered synonymous and interchangeable by the Halons Technical Options Committee in the context of its reports.

13. Regarding decision XXIX/8, the International Civil Aviation Organization (ICAO) had established an informal working group to determine the uses and emissions of halon 1301 within civil aviation fire protection systems which should enable the Committee to better understand the future supply and demand of halons. Also related, under decision XXVI/7, the Committee was working with the International Maritime Organization (IMO) to update the report on the future availability of halons by assessing the quantity of halons installed on merchant ships and the quantity and quality of halons being recovered from ship-breaking activities. In that regard, the parties might wish to consider whether a more formal relationship, to support that and other ozone-related activities, would be worth pursuing.

14. Civil aviation appeared to be on schedule to meet the ICAO requirement of using alternative agents in portable extinguishers on new production aircraft after 31 December 2018. The alternative agent was 2-bromo-3,3,3-trifluoro-prop-1-ene (2-BTP).

15. Lastly, Mr. Chattaway explained that although research to identify potential new fire protection agents continued, the timescale for research and development and regulatory approval was quite long, and it could be 5 to 10 years before a viable agent would have a significant impact on the fire protection sector.

4. Refrigerants Technical Options Committee

16. In presenting the Refrigerants Technical Options Committee's progress report, co-chair, Mr. Roberto Peixoto, said that with the adoption of the Kigali Amendment, research and development for low-GWP refrigerant HFCs use was under way in all sectors, and that energy efficiency remained an important consideration. He mentioned that long-term solutions had been identified for some applications, for example domestic refrigeration with HC-600a, and commercial refrigeration with R-744. In transitioning to low-GWP refrigerants, over 90 per cent of the energy efficiency improvements were attributable to improvements in equipment efficiency, while 5–10 per cent were due to the refrigerant fluid itself. He mentioned that the risk of flammable refrigerants was specific to different applications, and different regions, for example, high ambient temperature conditions, underscoring that the higher refrigerant charge, together with the capability of technicians in the service sector, were important factors in assessing risk. He reported significant progress with the development of new safety standards for flammable refrigerants, although it remained unclear when those would be completed.

17. Mr. Peixoto indicated that the Association of Home Appliance Manufacturers of North America had announced a voluntary goal to phase down HFC-134a in household refrigerators and freezers by 2024. Further, the use of R-744 (carbon dioxide) in supermarket refrigeration was increasing worldwide, both in cascaded systems and trans-critical systems, and such systems were being optimized in an effort to increase their energy efficiency. Mr. Peixoto went on to say that in Europe and the United States, field testing of a large number of blends, such as R-448A, R-449A, R-449B, R-452A, R-407H, R450A and R-513A, was expanding.

18. With respect to transport refrigeration, R-452A had achieved market penetration in newly produced trucks and trailers in Europe; several hundred refrigerated marine container units using R-744 were involved in field trials; and all fishing vessels built in Europe used R-717 or a R-717/R-744 cascade.

19. Referring to residential split air-conditioners, Mr. Peixoto said that HFC-32 was widely used in Japan, with its use increasing in some countries of south east Asia and Europe. The production of HC-290 units continued in India, while production line conversions were under way in several countries and further conversion of production lines to HC-290 was ongoing in China. He mentioned that safety standards were limiting the commercial introduction of larger units in China.

20. In closing, he referred to mobile air-conditioners, noting that the majority of new light vehicles in Europe and many in the United States and other countries used HFO-1234yf; that counterfeit refrigerants were a major issue; and that the issue was likely to become even more significant as more expensive HFO-1234yf refrigerants became available. In addition, R-744 was an alternative, which

some premium models had started using in 2017, and was under evaluation for use in heat pumps in electric vehicles.

5. Medical and Chemicals Technical Options Committee

21. Ms. Helen Tope, co-chair of the Medical and Chemicals Technical Options Committee, presented highlights from its progress report. She reported that the global transition away from CFC metered-dose inhalers was complete after 25 years of effort. In 2016, total global production of ozone-depleting substances for feedstock uses was about 1.2 million tonnes, with low estimated emissions of around 2,000 ODP tonnes. The largest current reported feedstock uses were HCFC-141b at 45 per cent of the total quantity, carbon tetrachloride at 19 per cent and HCFC-142b at 11 per cent. She presented the Committee's review of information submitted by parties on process agent use exemptions, make-up and emissions. Based on the information reported, she highlighted that parties might wish to consider removing from Table A of decision XXIX/7 the use of CFC-113 in the preparation of perfluoropolyether diols with high functionality, and the removal of the European Union from the same table under the application "chlorine recovery by tail gas absorption in chlor-alkali production". She also suggested that parties might wish to consider reducing the quantities of make-up/consumption and maximum emissions levels set out in Table B of decision XXIII/7, in the light of the currently reported process agent uses and emissions. In relation to laboratory and analytical uses, in 2017 China had announced its commitment to phase out the use of carbon tetrachloride for the analytical testing of oil in water by 2019. She reported that in response to decision XXVI/5(2) on laboratory and analytical uses of ozone-depleting substances, the Committee planned to report to the Thirtieth Meeting of the Parties, focusing on the major ozone-depleting substances in that application and considering Article 5 and non-Article 5 parties. Information was being collected about those uses and possible alternatives. Investigations into analytical procedures were proving challenging. The Committee would welcome available information from parties.

6. Methyl Bromide Technical Options Committee

22. The co-chairs of the Methyl Bromide Technical Options Committee, Ms. Marta Pizano and Mr. Ian Porter, presented the Committee's progress report and an overview of the interim recommendations for the critical-use nominations submitted in 2018 for use in 2019 and 2020.

23. In addressing the Committee's 2018 progress report, Ms. Pizano said that the phase-out of methyl bromide for reported controlled uses was almost complete (150 t for critical-use exemptions), but that a large quantity of methyl bromide still in use may not be reported. She recalled that the original global baseline for controlled consumption of methyl bromide was about 64,000 t. The Committee had made estimates that up to 15,000–20,000 t of methyl bromide might still be used annually, consisting of unreported consumption for controlled uses, quarantine and pre-shipment (about 10,000 t per annum and up to half of which was replaceable), and possible illegal trade. An estimated 2,000 t of methyl bromide might currently be used by some Article 5 parties from pre-2015 stocks for critical-use sectors. Those parties were not seeking exemptions and so did not report under Article 7. In reference to controlled uses, she reported that a wide range of non-chemical and chemical fumigant options and technologies which avoided methyl bromide had successfully been adopted around the world. The phase-out of the remaining critical uses of methyl bromide would be greatly influenced by the registration of sulfuryl fluoride, methyl iodide and other chemicals, and the use of soilless culture and other non-chemical options.

24. In closing, Ms. Pizano said that the Committee continued to work with the International Plant Protection Convention on quarantine uses of methyl bromide and identifying alternatives.

25. Mr. Porter then provided an overview of the outcomes of the assessment of critical-use nominations submitted in 2018. He stated that four countries (Australia, Canada, Argentina and South Africa) had applied for 150.741 t of methyl bromide under critical uses in six sectors. He provided an overview of the four non-Article 5 interim recommendations for the pre-plant use of methyl bromide.

26. For the Australian strawberry runners, the amount of 28.98 t had been reduced by 10 per cent based on the uptake of soilless production technologies. It was recognized that the party had provided a transition plan which provided good progress and showed that if methyl iodide was registered the nomination could be cut in half and no more requests would be made by the party beyond use in 2021. Good progress was being made with 1,3-D/Pic (TF80).

27. For Canadian strawberry runners, in 2019 the Committee had noted that despite groundwater contamination concerns with the existing methyl bromide use (MB/Pic 67:33), the same regulations enforced by the Prince Edward Island government prevented the consideration of the key fumigant alternatives for that nomination. Therefore, the Committee considered that the most sustainable

alternative was the adoption of soilless culture and had reduced the nomination amount of 5.261 t by 10 per cent.

28. Mr. Porter then showed that the amounts of methyl bromide requested in nominations from five Article 5 parties since 2015 had continued to decline. China was no longer seeking any critical-use exemption for methyl bromide in the current round and Mexico had not sought amounts of methyl bromide since the 2015 round. The Committee had been unable to determine whether those parties had phased out methyl bromide or were using stocks given that stocks gathered before 2015 were not reported by parties.

29. For the tomato and strawberry sectors in Argentina in 2019, the interim recommendations showed that nominations had decreased as a consequence of the uptake of barrier films for the third year of a three-year adoption period, which had allowed for the reduced use of methyl bromide. For tomatoes, the Committee accepted that alternatives for controlling *Nacobbus* (e.g., resistant rootstock for grafting) were not yet available. Both nominations from Argentina for 2019 (strawberry fruit – 27.1 t, tomatoes - 44.4 t) had been reduced by 10 per cent to meet the standard presumptions for methyl bromide dosage rates used with barrier films over a three-year adoption period.

30. Mr. Porter then provided the outcome of the two interim recommendations for pests in commodities and structures for 2019 from South Africa. For mills, the Committee had recommended a 90 per cent reduction of the 2.0 t nominated, based on the allowance of only one fumigation per year at a 20 g/m^3 dose rate to allow time for the adoption of integrated pest management and sulfuryl fluoride which was now registered in South Africa. For houses, the Committee had recommended a 33.5 per cent reduction based on the adoption of alternatives (heat), which met the requirements for pest freedom for the sale of houses.

7. Technology and Economic Assessment Panel administrative issues

31. The co-chair of the Technology and Economic Assessment Panel, Mr. Woodcock, gave a presentation on organizational matters related to the Panel, emphasizing the evolving nature of the work and membership in order to meet the current and future needs of parties, with the Panel and its technical options committees structured in terms of size and expertise to support those efforts.

32. He explained that the Panel consisted of 3 co-chairs, 12 technical options committees co-chairs and 6 senior experts, and that 7 members of the Panel were reaching the end of their appointments in 2018. The Panel had been the subject of a substantial increase in workload, and was at risk of the loss of expertise through attrition or lack of support or funding. The Panel and its technical options committees were continually working to identify appropriate candidates, and he encouraged parties to suggest candidates based on the matrix of required expertise.

33. He pointed out that many Panel members were volunteers who were finding it hard to sustain the current level of activity in the context of a full-time occupation. He requested parties to consider the overall workload, delivery deadlines and level of support to the Panel. In closing, he emphasized that the Technology and Economic Assessment Panel belonged to the parties and aimed to support and serve those parties.

B. Report of the Technology and Economic Assessment Panel task force on issues related to energy efficiency while phasing down HFCs (decision XXIX/10)

34. Ms. Suely Carvalho, Ms. Bella Maranion and Mr. Fabio Polonara, co-chairs of the energy efficiency task force, gave a presentation on the report of the Technology and Economic Assessment Panel task force on issues related to energy efficiency while phasing down HFCs (decision XXIX/10). Ms. Maranion started by elaborating on the mandate set out in decision XXIX/10, in which the parties had requested the Technology and Economic Assessment Panel to prepare a report in relation to maintaining and/or enhancing energy efficiency in the refrigeration and air-conditioning and heat pump (RACHP) sectors, including in high-ambient temperature conditions, while phasing down HFCs under the Kigali Amendment, to assess certain technology options and requirements, related costs including capital and operating costs. In addition, the parties had requested the Panel to provide an overview of the activities and funding provided by other relevant institutions. The report structure and the presentation followed closely the outline of the decision request. Ms. Maranion provided the list of the 21 members of the task force, which included members of the Panel and its technical options committees as well as a number of outside experts, with due consideration for the needed expertise as well as gender and geographical balance. After consultations with national focal points and the appointment of members, the task force had commenced its work in January 2018, met in April in the margins of the Panel's annual meeting, and completed its report in May.

35. Mr. Polonara provided an overview of the technology options and requirements beginning with the opportunities for energy efficiency improvement in the RACHP sectors. The largest potential was from improvements in total system design (10–70 per cent for "best in class" unit) with refrigerant choice being relatively small (typically ranging from +/- 5 to 10 per cent). He emphasized the opportunities for energy efficiency improvements or reduction of energy use. He provided examples of design efficiency improvements based on European conditions, and the range of improvements possible (such as the use of inverter/variable speed compressors with a range of 20–25 per cent improvement). He then focused on the challenges for uptake of higher energy efficiency technologies and defined those as financial, market-specific, information, institutional and regulatory, technical, and service competency and others. In decision XXIX/10, the parties had also asked the Panel to consider the long-term sustainable performance and viability of those technologies. He noted that the Panel historically defined "long-term" as 15 years and that the term "sustainable performance and viability" referred to whether or not those technologies remained viable over that 15-year period. Relevant aspects of the long-term sustainable performance and viability of the RACHP technologies also included the technological environment, codes and standards including minimum energy performance standards (MEPS) and consideration of the whole supply chain, including the end user and industry engagement. He highlighted the combined "push-and-pull" effect of MEPS, labels and other incentive programmes on the sales of higher efficiency equipment. In closing, he considered the challenges for energy efficiency equipment of selection of refrigerants, system design and energy efficiency enhancement opportunities under high ambient temperature conditions.

36. Ms. Maranion noted that in the decision, the parties had also requested the Panel to assess the technology options and requirements including their environmental benefits in terms of carbon dioxide equivalence (CO_2eq). The environmental benefits of RACHP technology in terms of mitigation of global warming could be assessed by greenhouse gas emission reduction in terms of CO_2eq. Greenhouse gas emissions consisted of direct and indirect contributions. The direct contribution was due to the emission of refrigerants into the atmosphere, while indirect emissions were due to the energy required to operate the equipment. Over 80 per cent of the global warming impact of RACHP systems was associated with the indirect emissions generated during the production of the electricity used to operate the equipment. The environmental impact of improving system efficiency was a factor of the type of equipment, for how many hours and when the equipment was used (influenced by ambient temperature and humidity conditions), and the emissions associated with generating power, which varied by country. Given uncertainties in future demand projections, the task force had considered a simplified, practical approach in its report to calculate the environmental benefits in terms of CO_2eq for technology options that enhanced energy efficiency compared to a baseline model unit. That allowed for a calculation of the environmental benefits against a business-as-usual baseline efficiency for new equipment purchases based on commercially available products. She explained that the calculation of environmental benefits involved three steps: (a) identifying the baseline model unit energy consumption (examples used came from country assessments and product registries); (b) calculating the energy savings for higher efficiency models as a function of baseline unit energy consumption and hours of use (which varied significantly by country, climate and application); and (c) converting energy savings to CO_2eq by multiplying by the end-use emission factor for electricity generation (examples were based on default fuel emissions factors from the Intergovernmental Panel on Climate Change inventory guidelines and generation mix and transmission and distribution loss data from the International Energy Agency). She noted that examples were considered in various equipment types: room air-conditioning, domestic refrigeration, heat pumps, commercial refrigeration, and mobile air-conditioning. Based on the available information, the report provided calculation results for room air-conditioning, domestic refrigeration, and commercial refrigeration examples. For each equipment type, the task force had developed three to five scenarios covering a range of hours of use (with the highest hours of use generally associated with operation under high ambient temperature conditions) and electricity emissions factors. The task force had also considered three levels of efficiency: baseline; higher energy efficiency (generally market average or better); and highest energy efficiency (best available on a representative market). The energy efficiency improvement was characterized in terms of per cent improvement in unit energy consumption (based on commercially available models in markets consistent with the scenarios presented). She then provided the calculation results for the room air-conditioning example showing the annual environmental benefits per unit across scenarios of higher efficiency units (10–20 per cent higher than baseline) and highest efficiency units (40–50 per cent higher than baseline). Scenarios also varied hours of use and electricity emissions factors. Hours of use and electricity emissions factors were representative of situations in actual climate zones around the world. The five cases ranged from very low case (consisting of very low hours of annual equipment use (350 hours/year) and low electricity emissions factor) to the highest case with high hours of annual use (2880 hours/year) and high electricity emissions factor.

37. In decision XXIX/10, the parties had also requested the Technology and Economic Assessment Panel to assess the technology options and requirements including servicing sector requirements in the RACHP sectors. She noted that a significant concern in most Article 5 parties in the HCFC phase-out process was the training of technicians in the use of new refrigerants. Energy efficiency aspects required additional training and further awareness. Some energy efficiency degradation over the lifetime of the equipment was inevitable; however, there were ways to limit the degradation through improved design and improved servicing, which included both installation and maintenance. The impact of proper installation, maintenance and servicing on the efficiency of equipment and systems was considerable over the lifetime of those systems while the impact on additional cost was minimal. She noted that the benefits of proper maintenance were considerable – appropriate maintenance and servicing practices could curtail up to 50 per cent reduction in performance and maintain the rated performance over the lifetime of the equipment. In most instances the methods to maintain and/or increase energy efficiency were inseparable and indistinguishable from "best practices" for maintenance and installation. Some of the ways to achieve better servicing practices to improve energy efficiency included: improved training and education of service technicians, system operators, and refrigerant handlers through new courses and curricula; certification of technicians and other entities on handling refrigerants and also possibly linked to certification for proper system maintenance; policies to encourage regular maintenance and servicing with actions such as having maintenance contracts or warranties included as part of procurement. She then provided a table showing examples of the effects of not undertaking proper maintenance and set point adjustments to the rated efficiency of the equipment.

38. In decision XXIX/10, the parties had also requested the Technology and Economic Assessment Panel to assess, in the context of technology options and requirements, the capacity-building requirements for the RACHP sector. Ms. Maranion noted that there were enabling activities, such as capacity-building, institutional-strengthening, demonstration projects, and national strategies and plans, that helped to bridge the Montreal Protocol activities under the Kigali Amendment and energy efficiency. A number of enabling activities supported by other funds, such as the Kigali Cooling Efficiency Programme (K-CEP) and the Global Environment Facility (GEF), had advanced both ozone depletion goals and energy efficiency goals. Several categories of enabling activities had the potential to bridge activities related to enhancing or maintaining energy efficiency with HFC phase-down activities. She presented a table summarizing enabling activity projects supported by K-CEP and GEF to provide an indication of costs; noting that it provided only some examples of projects for a very limited number of countries. Technical capacity-building activities for manufacturing could include information exchange and data sharing analysis on design options and their costs, component sourcing for maintaining or enhancing equipment energy performance (particularly at HAT conditions) and for selection of low-GWP alternatives with significant energy efficiency benefits. Training activities could include development of new curricula, case studies, training sessions integrating energy efficiency best practices. Institutional-strengthening bridging activities could include training and networking for national ozone units and policymakers to integrate energy efficiency goals to the HFC phase-down approach; increasing awareness through public communication and outreach to industries and consumers or retailers; customs training and updated manuals. Demonstration projects could include the development on national rebate and exchange programmes; procurement or buyers' club approaches; and the testing of new technologies and designs that enhanced energy efficiency. Lastly, she noted that enabling activities could also include support for national strategies and plans to integrate energy efficiency goals into HCFC phase-out and HFC phase-down planning.

39. In responding to the decision, Ms. Carvalho presented an overview of an analytical approach to evaluating capital and operating costs for each product, emphasizing steps such as consumer life cycle and payback costs and costs to the manufacturer, which were relevant to the calculation of capital and operating costs. She pointed out that rigorous costs analysis was needed for costs calculations and that those steps could take from one to two years. Therefore, she referred parties to two examples of market transformation programmes for promoting energy efficiency, including MEPS and labelling programmes in the United States of America and the European Union. She presented some examples based on products already introduced on the market, such as an example for an Indian air-conditioner indicating the efficiency improvement opportunities versus energy savings and manufacturing costs. She highlighted that there was limited publicly available data on capital and operating costs and that retail prices alone were not good indicators for the costs of maintaining or enhancing energy efficiency. Other examples were provided, the first showing the benefits of economies of scale in the domestic refrigeration sector and the impact on the decline of prices to the consumer over time as higher efficiency equipment began to be produced at scale and standards were put in place; the second elaborating on the life cycle costs at three different efficiency levels, representing 90 per cent of the market of one air-conditioner type in India, indicating that the overall

life cycle cost could be reduced when transitioning to a more efficient air-conditioner, despite an increase in system price, while maintaining installation cost. The refrigerant contribution to final cost was less than 1 per cent for that case study. In closing, Ms. Carvalho explained that the task force approach to evaluating other funding institutions was to consider where those institutions specifically intersected with the objective of providing support for addressing energy efficiency in the RACHP sectors while phasing down HFCs. Recognizing the limited amount of time for presenting a more robust mapping, she drew attention to the examples provided in the annexes to the report, noting that the mapping exercise covered a limited number of institutions, such as GEF, K-CEP, the Green Climate Fund, the World Bank Group, Global Energy Efficiency and Renewable Energy and GIZ.

Annex III

Additional guidance to the Technology and Economic Assessment Panel on energy efficiency

1. More information on the heat pump sector and CO_2 savings.

2. Tabular presentation of funding sources.

3. More information on opportunities/energy efficiency improvements in the mobile air-conditioning sector.

4. More information on lessons learned from previous transitions in terms of additional energy efficiency gains and resources.

5. Information on additional gains from improved servicing.

6. Elaborate more on the design and criteria of RACHP units in particular with respect to safety, performance and the consequences of increasing the capacity of those units.

7. Elaborate in a comprehensive way and provide clear comparison between HCFCs, HFCs and HFC alternatives with respect to performance, safety and costs.

8. Focus on the energy efficiency of the equipment in the RACHP, avoiding duplication of work undertaken under other international entities such as the IPCC.

9. Look at measures taken at other regions (such as the EU) in recent years and address the particular challenges faced by HAT countries.

10. Request TEAP to reach out to the various regions to understand better their particular circumstances.

11. Report on what research and development is occurring, and its progress and outcomes, to address high ambient temperature challenges.

12. For the TEAP to visit the regions to engage with stakeholders on the challenges of the regions in transitioning to higher energy efficiency refrigerants.

13. Calculate the lifecycle of equipment per country/region and associated climatic conditions.

14. Provide more information on specific economic benefits in terms of savings to including to consumers, power plants, payback periods.

15. Reformulate TEAP's response to decision XXIX/10 to put in in the context of refrigerant transition.

16. Provide further information on the following takeaway messages from the EE workshop:

    (a) The initial "price hump" in the introduction of high-energy-efficiency technologies;

    (b) How refrigerant selection needs to be made in terms of energy efficiency, flammability and other relevant factors;

    (c) Availability of funds that are, however, not easily flowing.

17. Quantify the context/site-specific impacts of environmental benefits of EE equipment, as mentioned in the TEAP report.

18. Provide a matrix of technical interventions to EE and associated costs.

19. Elaborate on the criteria and methodologies of the relevant funding institutions noted in decision XXIX/10.

20. Elaborate on the capacity building and servicing requirements for low-GWP alternatives.

21. Explore the possibility of district cooling, green buildings code and hydrocarbons in commercial applications to be options for EE (as is demonstrated in UAE).

22. Provide information on increased energy demand to produce the same amount of cooling in HAT countries due to the projected rise of temperature.

23. Consider visiting UAE to view the district cooling, green-cooling and hydrocarbon projects to inform its updated final report.