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EXECUTIVE COMMITTEE OF  
THE MULTILATERAL FUND FOR THE  
IMPLEMENTATION OF THE MONTREAL PROTOCOL  
Eighty-third Meeting  
Montreal, 27– 31 May 2019

**PAPER ON WAYS TO OPERATIONALIZE PARAGRAPH 16 OF DECISION XXVIII/2  
AND PARAGRAPH 2 OF DECISION XXX/5 OF THE PARTIES (DECISION 82/83(c))****Background**

1. At its 82<sup>nd</sup> meeting, the Executive Committee considered a document prepared by the Secretariat presenting a summary of the Parties' deliberations at the 40<sup>th</sup> meeting of the Open-Ended Working Group (OEWG) of the Parties and the Thirtieth Meeting of the Parties to the Montreal Protocol in relation to the report by the Technology and Economic Assessment Panel (TEAP) on issues related to energy efficiency.<sup>1</sup>
2. The document briefly presented *inter alia* the actions taken in response to decision XXIX/10,<sup>2</sup> particularly regarding the TEAP report on issues related to energy efficiency, and the workshop on energy efficiency opportunities while phasing down HFCs held in the margins of the 40<sup>th</sup> meeting of the OEWG.
3. Following the discussion, the Executive Committee *inter alia* requested the Secretariat to prepare a paper for consideration by the Executive Committee at its 83<sup>rd</sup> meeting, describing ways to operationalize paragraph 16 of decision XXVIII/2, and paragraph 2 of decision XXX/5, taking into account the criteria, performance indicators, and associated funding mechanisms of servicing sector plans in existing or new HCFC phase-out management plans (HPMPs) for low-volume-consuming (LVC) countries (decision 82/83(c)).

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<sup>1</sup> UNEP/OzL.Pro/ExCom/82/65 and Add.1

<sup>2</sup> Decision XXIX/10 requested, in relation to maintaining and/or enhancing energy efficiency in the refrigeration, air-conditioning and heat-pump (RACHP) sectors, an assessment of: technology options and requirements including challenges for their uptake, and their long-term sustainable performance and viability, their environmental benefits in terms of CO<sub>2</sub>-eq; capacity building and servicing sector requirements in the RACHP sectors; related capital and operating costs. It also requested the TEAP to provide an overview of the activities and funding provided by other relevant institutions addressing energy efficiency in the RACHP sectors in relation to maintaining and/or enhancing energy efficiency while phasing down HFCs under the Kigali Amendment. Further, it requested the Ozone Secretariat to organize a workshop on energy efficiency opportunities while phasing down HFCs at the 40<sup>th</sup> meeting of the OEWG, and, thereafter, for the TEAP to prepare an updated final report for the Thirtieth Meeting of the Parties, taking into consideration the outcome of the workshop.

An analysis of decision 82/83(c)

4. Decision 82/83(c) refers directly to paragraph 16 of decision XXVIII/2<sup>3</sup> and paragraph 2 of decision XXX/5,<sup>4</sup> and incorporates paragraph 1 of decision XXX/5<sup>5</sup> (support for energy efficiency policy and training support as it relates to the phase-down of controlled substances), as well as paragraph(c)(xii) of decision 74/50<sup>6</sup> (funding mechanisms for servicing sector plans).

5. Incorporating the text of the relevant decisions would lead to the following reading of decision 82/83(c):

To request the Secretariat to prepare a paper for consideration by the Executive Committee at its 83<sup>rd</sup> meeting, describing ways to operationalize an increase in funding, in relation to the servicing sector, available under decision 74/50 for LVC countries, when needed, for (a) the introduction of low- and zero-global warming potential (GWP) alternatives to HCFCs or HFCs and maintaining energy efficiency in the servicing/end-user sector<sup>7</sup>; (b) developing and enforcing policies and regulations to avoid the market penetration of energy-inefficient RACHP equipment and promoting penetration of energy-efficient equipment, supported by targeted training on certification, safety and standards, awareness raising and capacity building<sup>8</sup>; (c) taking into account the criteria, performance indicators, and associated funding mechanisms of servicing sector plans in existing or new HCFC phase-out management plans.

6. From the above, it is noted that the focus of this decision is on increasing funding available under decision 74/50 for HPMPs for LVC countries for the introduction of low- and zero-GWP alternatives to HCFCs or HFCs and maintaining energy efficiency while addressing the HCFC consumption in the servicing sector.

7. The Secretariat prepared the present document in response to decision 82/83(c) in light of the above.

Scope of the document

8. The document consists of the following sections addressing specific issues relating to the service sector for LVC countries<sup>9</sup>:

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<sup>3</sup> To request the Executive Committee to increase in relation to the servicing sector the funding available under decision 74/50 above the amounts listed in that decision for parties with total HCFC baseline consumption up to 360 metric tonnes, when needed, for the introduction of alternatives to HCFC with low-GWP and zero-GWP alternatives to HFC and maintaining energy efficiency also in the servicing/end-user sector.

<sup>4</sup> To request the Executive Committee to consider, within the context of paragraph 16 of decision XXVIII/2, increasing the funding provided to LVC countries to assist them in implementing the activities outlined in paragraph 1 of this decision.

<sup>5</sup> To request the Executive Committee to consider flexibility within the financial support provided through enabling activities for HFCs to enable Article 5 Parties, who wish to do so, to use part of this support for energy efficiency policy and training support as it relates to the phase-down of controlled substances, such as: developing and enforcing policies and regulations to avoid the market penetration of energy-inefficient refrigeration, air-conditioning and heat-pump equipment; promoting access to energy-efficient technologies in these sectors; and targeted training on certification, safety and standards, awareness raising and capacity building aimed at maintaining and enhancing the energy efficiency.

<sup>6</sup> Article 5 countries with total HCFC consumption of up to 360 metric tonnes would be provided with funding consistent with the level of consumption in the servicing sector, on the understanding that project proposals would still need to demonstrate that the funding level was necessary to achieve the 2020 and 2025 phase-out targets, or if the country so decided, later reduction targets.

<sup>7</sup> Paragraph 16 of decision XXVIII/2

<sup>8</sup> Paragraph 2 of decision XXX/5

<sup>9</sup> Many of the issues discussed here are applicable to service sector for non-LVC countries also.

Introduction of low- and zero-GWP alternatives to HCFCs or HFCs: presents an overview of the refrigeration servicing sector and the regulatory framework that has been established in Article 5 countries, allowing *inter alia* implementation of controls on imports of RACHP equipment based on high-GWP controlled substances. It discusses the potential barriers for the introduction of low- and zero-GWP alternative technologies and how Article 5 countries are addressing these barriers during the implementation of their HPMPs. It also presents an overview of the adoption of standards and how they can be useful in supporting the adoption of low-GWP alternatives in the context of the HCFC phase-out.

Developing and enforcing policies and regulations to avoid the market penetration of energy-inefficient RACHP equipment and promoting market penetration of energy-efficient equipment: presents an overview of energy efficiency policies commonly used, with an emphasis on the minimum energy performance standard (MEPS) and labelling programmes; it presents a list of 43 Article 5 countries with programmes in place for MEPS and labelling; and discusses the application of MEPS for controlling imports of “inefficient” energy efficiency RACHP equipment together with regulations favouring the introduction of low- and zero-GWP alternative refrigerants<sup>10</sup>.

Maintaining energy efficiency in the servicing sector: briefly discusses the effect of installation, maintenance and servicing practices in ensuring the efficient operation of the RACHP equipment at the highest feasible energy efficiency over the lifetime of the equipment.

Targeted training on certification, safety and standards, awareness raising and capacity building: presents an overview of the targeted training on certification, safety and standards, awareness-raising and capacity-building in support of the introduction of energy-efficient low- or zero-GWP alternative technologies currently undertaken in HPMPs, and additional activities that might be needed on these matters.

Criteria, performance indicators, and associated funding mechanisms of servicing sector plans in existing or new HPMPs: identifies additional activities that might be required for the adoption of energy-efficient RACHP equipment operating with low- and zero-GWP refrigerants, based on the review of the regulatory framework and the phase-out plans of controlled substances, in particular those related to the refrigeration servicing sector. It proposes a set of performance indicators and a brief analysis of costs as well as funding modalities.

9. In preparing the present document, the Secretariat took into consideration information related to energy efficiency contained in the following documents previously considered by the Executive Committee or the Parties to the Montreal Protocol:<sup>11</sup>

- (a) Issues relevant to the Executive Committee arising from the Twenty-eighth Meeting of the Parties to the Montreal Protocol;<sup>12</sup>
- (b) Information relevant to the development of the cost guidelines for the phase-down of HFCs in Article 5 countries: draft criteria for funding;<sup>13</sup>

<sup>10</sup> Integrated regulations addressing MEPS and labelling and low-GWP / zero-GWP refrigerants in RACHP sectors are essential to avoid unintended growth of high-GWP refrigerant based RACHP equipment.

<sup>11</sup> To facilitate the discussion of the Executive Committee, the relevant text of the documents has been incorporated into the present document.

<sup>12</sup> UNEP/OzL.Pro/ExCom/77/70/Rev.1 (paragraphs 50 to 57).

<sup>13</sup> UNEP/OzL.Pro/ExCom/78/5 and Corr.1 (paragraphs 107 to 115 and Annex V).

- (c) Preliminary document on all aspects related to the refrigeration servicing sector that support the HFC phase-down (decision 80/76(c)).<sup>14</sup> The document presents a comprehensive overview of the refrigeration servicing sector in all Article 5 countries, and addresses in detail most of the elements in decision 82/83(c); and
- (d) Decision XXIX/10 Task Force report on issues related to energy efficiency while phasing down HFCs, UNEP TEAP, September 2018.

10. The Secretariat also considered:

- (a) Policies and decisions of the Multilateral Fund and the Meeting of the Parties related to energy efficiency;
- (b) The experience in the Multilateral Fund during implementation of projects that included energy efficiency performance indicators and the evaluation by the Senior Monitoring and Evaluation Officer of chiller projects;
- (c) Discussions with refrigeration servicing sector stakeholders in Article 5 countries and non-Article 5 countries, held during missions and during meetings at the Secretariat between February and April 2018;
- (d) Information presented at the workshop on safety standards relevant to the safe use of low-GWP alternatives<sup>15</sup> and at the workshop on energy efficiency opportunities while phasing down HFCs,<sup>16</sup> held in the margins of the 39<sup>th</sup> and 40<sup>th</sup> meetings of the OEWG, respectively;
- (e) Discussions with representatives from bilateral and implementing agencies on all aspects of the refrigeration servicing sector, during Inter-agency coordination meetings (IACMs) held in 2018 and 2019;<sup>17</sup> and
- (f) Documents issued by different institutions including bilateral and implementing agencies.

11. The Secretariat appreciates the insights, information and comments provided by the bilateral and implementing agencies during the discussions at the IACMs.

12. The Secretariat also sought advice from an independent expert on the technical aspects included in the present document. Relevant comments from the expert have been incorporated accordingly.

### **Introduction of low- and zero-GWP alternatives to HCFCs or HFCs**

13. Since the inception of the Multilateral Fund in 1991, the Executive Committee has considered funding activities in the refrigeration servicing sector<sup>18</sup> to be a priority, given that part or all of the controlled substances are used in this sector. The Secretariat notes that the support provided to the service sector has facilitated adoption of ODS-free alternative technologies, and has not directly resulted in the adoption of alternative technologies, as has been the case during the conversion of the manufacturing sector.

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<sup>14</sup> UNEP/OzL.Pro/ExCom/82/64 (all the information contained therein is relevant for consideration of the present document). Paragraphs 77 to 83 refer specifically to considerations on energy efficiency in the servicing sector.

<sup>15</sup> Bangkok, 10 July 2017.

<sup>16</sup> Vienna, 9-10 July 2018.

<sup>17</sup> 6-8 March 2018; 4-6 September 2018; and 5-7 March 2019.

<sup>18</sup> For the purpose of this document, the term “refrigeration servicing sector” will refer to both refrigeration and air-conditioning.

14. Initial activities in the service sector were implemented as stand-alone projects, consisting of training refrigeration technicians in good servicing practices, providing basic tools and equipment for technicians, and establishing refrigerant recovery and recycling schemes. Assistance was also provided for the development and implementation of specific legislation, policies and regulations and capacity building for customs and enforcement authorities for monitoring and controlling the controlled substances under the Montreal Protocol.

15. As the phase-out programme progressed, the stand-alone activities were subsumed into a holistic sector plan that would manage the phase-out of controlled substances used for servicing RACHP equipment,<sup>19</sup> taking into consideration the circumstances prevailing in the country concerned. The servicing sector activities resulted in better operations and maintenance practices while installing, maintaining and servicing equipment and thus, contributed to energy efficient operations of the equipment, indirectly and supported adoption of low- and zero-GWP options, mainly through technical capacity building for adopting alternative technologies.

16. In response to decision XIX/6 on adjustments to the Montreal Protocol with regard to HCFCs, the Executive Committee proposed a staged approach to allow countries to develop an overarching plan to achieve total phase-out of HCFCs while allowing for proposals to achieve the first two control measures in 2013 and 2015, and at the same time, allowing proposals for a subsequent stage, or stages if needed, to achieve complete phase-out. Since the 60<sup>th</sup> meeting (April 2010), stage I and in many cases stage II of HPMPs have been approved for all Article 5 countries, except for the Syrian Arab Republic. Decision XIX/6 requested Parties to promote the selection of alternatives to HCFCs that minimize environmental impacts, in particular impacts on climate, as well as meeting other health, safety and economic considerations and requested the Executive Committee to give priority to projects and programmes, which focus on, *inter alia*, GWP and energy use; this provided for implementation of activities to facilitate adoption of low- and zero-GWP options.

17. The implementation of the refrigeration servicing sector plans supported by the regulatory framework in place contributed to continuous compliance with the Montreal Protocol provisions by all Article 5 countries,<sup>20</sup> and to reductions in consumption of controlled substances in line or in advance of the phase-out control targets established under the Protocol.<sup>21</sup> Furthermore, this has allowed several Article 5 countries to establish, or to consider establishing, controls including prohibition of manufacturing (where applicable) and/or on import of controlled-substance-based RACHP equipment, limiting their growth and reducing the size of the installed base of such equipment.

18. Despite the above efforts, progress reports on the implementation of HPMPs, and other evaluation reports indicate that high-GWP-refrigerant-based equipment (mainly R-410A in air-conditioning) have increasingly been imported into Article 5 countries over the last decade. However, the Kigali Amendment has triggered discussions and some initial actions, on controlling the use of high-GWP refrigerants in Article 5 countries. Given that equipment based on low- or zero-GWP refrigerants have different operating characteristics related to pressure, flammability and toxicity, the current legislation, regulations, and codes

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<sup>19</sup> The strategy could include *inter alia* economic incentives and disincentives targeting suppliers, service technicians and equipment owners; technician training; public awareness activities; customs controls on new CFC-based equipment; the retirement of existing CFC-based equipment; and an increase in the supply of recycled CFCs.

<sup>20</sup> Since the ratification of the Montreal Protocol, there have been a few countries that have been found to be in non-compliance with the Protocol. However, with the assistance of the Multilateral Fund, those Parties returned to compliance within a defined period.

<sup>21</sup> For example, funding has been approved in principle to phase out 62 per cent of the aggregate HCFC baseline for compliance in Article 5 countries, well ahead of the 35 per cent control measure in 2020.

of practice would need to be reviewed, updated and/or further developed, and standards<sup>22</sup> should be enforced to ensure safe operation and handling of the equipment.

19. The pace of introduction of low- or zero-GWP alternative technologies in various RACHP applications has been slower than originally expected in Article 5 countries, due to:

- (a) The availability of cost-effective, energy efficient equipment based on high-GWP alternatives;
- (b) The limited number of standards currently available related to the introduction, installation and servicing and maintenance of equipment based on flammable or toxic refrigerants;
- (c) The lack of standards for transportation of flammable or toxic refrigerants;
- (d) The slow pace of commercialization coupled with limited availability of some refrigerants or the equipment operating with low- or zero-GWP alternative;
- (e) The lack of building codes allowing the installation of RACHP equipment based on flammable refrigerants with a certain refrigerant charge; and
- (f) The availability of skilled and properly equipped refrigeration servicing technicians.

20. Article 5 countries are currently addressing several of these barriers through activities that are increasingly becoming standard components of the HPMPs. Article 5 countries have been encouraged to develop regulations and codes of practice, and to adopt standards for the safe introduction of flammable and toxic refrigerants. Article 5 countries have also been encouraged to limit the import of HCFC-based equipment mainly through regulatory interventions under HPMPs and facilitate the introduction of energy-efficient and climate-friendly alternatives; and to focus activities in the refrigeration servicing sector on training of technicians, good practices, the safe handling of refrigerants, containment, recovery and recycling, and reuse of recovered refrigerants rather than retrofitting.<sup>23</sup>

21. Training in the installation, operation, maintenance and disposal of RACHP equipment using flammable substances has been considered a priority during implementation of stages I and II of the HPMPs in countries where these refrigerants were already in the market or expected to be introduced.

22. In support to the work by national ozone units (NOUs), UNEP's Compliance Assistance Programme (CAP) developed a guide on international standards in refrigeration and air-conditioning, providing an introduction to standards and showing how they can be useful in supporting the adoption of low-GWP alternatives in the context of the HCFC phase-out. The guide also provides an overview of existing standards related to HCFCs and their alternatives; barriers to alternatives; the process for adopting international and regional standards at the national level; and barriers to the adoption of standards and how to overcome them.<sup>24</sup>

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<sup>22</sup> For substances, for equipment, for refrigerant containers, and on storage, transportation, design of systems and components, maximum refrigerant charge, installation, servicing and disposal of equipment, among others.

<sup>23</sup> Decision 72/41

<sup>24</sup> The standards covered in the guide are grouped into four main categories: (a) Safety standards for design, construction and installation of RACHP products and systems; (b) Performance standards for determining the efficiency and performance of RACHP systems and equipment, as well as for refrigerants; (c) Practice standards for identifying knowledge and guiding best practices for refrigeration technicians when handling RACHP systems and refrigerants; and (d) Quality standards covering any industry, but applicable to processes involving refrigerants such as production, accounting, certification and training.

23. While the above measures had an impact on adoption of low- and zero-GWP alternatives in RACHP equipment, market factors appear to have played a role in influencing the pace of adoption of these alternatives. Measures facilitating adoption of these alternatives as well as preventing high-GWP alternatives penetration may need to be further considered to enhance the pace of adoption of low- and zero-GWP alternatives.

**Developing and enforcing policies and regulations to avoid the market penetration of energy-inefficient refrigeration, air-conditioning and heat-pump equipment and promoting the market penetration of energy-efficient equipment**

24. The energy efficiency of any RACHP equipment is largely independent of the refrigerant charged in the systems. The global demand for equipment using high-GWP substances, e.g., R-410A, is currently among the highest for many years, leading equipment manufacturers to continuously improve the energy efficiency of such equipment. With the adoption of the Kigali Amendment, an increase in the pace of introduction of RACHP equipment based on low- or zero-GWP refrigerants (e.g., HFC-32, R-290) is expected. However, improving the energy efficiency will require equipment manufacturers to introduce technological advances in the design and key components of these equipment (e.g., compressors, heat exchangers, controls).<sup>25</sup>

25. One of the energy efficiency policy measures used globally is the MEPS, a specification of performance requirements for an energy-using device that effectively limits the maximum amount of energy that may be consumed by a product in performing a specified task.<sup>26</sup>

26. Regulations for controlling imports of energy-efficient RACHP equipment would require enforcing MEPS for equipment used in different applications and operating under different climatic conditions, and supported by labelling programmes providing more information to consumers. Defining the MEPS efficiency levels for avoiding energy-inefficient equipment would vary depending upon national product-market characteristics, consumer cost-economics, consumer preferences for adopting energy-efficient equipment, which is influenced by *inter alia* technology availability, ease of adoption, price of electricity and usage patterns. Further, MEPS levels need to be revised upwards every few years, keeping in view the technical developments of the RACHP equipment. Moreover, MEPS are largely independent of the refrigerant used.

27. Accordingly, while enforcing MEPS for supply and sale of equipment in local markets is essential for improving energy efficiency, complementary measures must be implemented concurrently to avoid an increased uptake of high-GWP refrigerant-based RACHP equipment. In particular, MEPS and regulatory measures addressing the import and use of high-GWP refrigerant-based equipment should be implemented concurrently to avoid the import of energy-efficient RACHP equipment based on high-GWP refrigerant (e.g., R-410A).

28. Other measures that could facilitate the adoption of energy-efficient equipment include labelling programmes that help consumers choose specific products with certain levels of efficiency; financial incentives in the form of rebates, tax credits, loan financing or leasing of energy-efficient equipment; and procurement programmes that encourage the purchasing of energy-efficient products at attractive prices. In addition, aspects relating to building design to reduce heating loads, temperature controls in cooling space, and refrigeration-equipment operation to prevent loss in cooling, have an impact on the energy efficiency

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<sup>25</sup> Energy labels results in differentiation of products making most efficient products fall in the high-price category with other associated features. The effect of MEPS is to push manufacturers to incorporate the energy-efficient components and designs into lower-priced (lower profit margin) larger-market product lines sooner than they otherwise would.

<sup>26</sup> In MEPS-making processes, energy efficiency policy makers compare the increase in purchase price for higher efficiency equipment against the energy savings to the consumer, and set the level of MEPS level to “pay back” the average consumer within a specified time period.

of equipment; raising the awareness of consumers and other relevant stakeholders through service agencies could encourage energy-efficient operation of equipment. These measures, aligned with MEPS and other regulatory measures that can avoid the adoption of high-GWP refrigerants, could be implemented in a manner to encourage the introduction of high-energy-efficiency equipment based on low- or zero-GWP alternatives.

29. Although specific regulations related to controlling imports of RACHP equipment based on their energy efficiency ratings have not been included under HPMPs, a large number of Article 5 countries have such regulations, which are enacted by the relevant authorities dealing with energy efficiency, as shown in Table 1.

**Table 1. Overview of 43 Article 5 countries with programmes in place for MEPS and labels<sup>27</sup>**

Country	Comparative labels <sup>28</sup>		Endorsement labels <sup>29</sup>		MEPS	
	Refrigerator	Room AC	Refrigerator	Room AC	Refrigerator	Room AC
Algeria	X	X			X	
Argentina	X	X			X	X
Bangladesh		X				
Barbados	X	X				
Bolivia (Plurinational State of)	X					
Brazil	X	X	X	X	X	X
Chile	X	X				
China	X	X	X	X	X	X
Colombia	X	X			X	X
Cook Islands	X	X			X	X
Costa Rica	X	X			X	X
Cuba	X	X				
Democratic People's Republic of Korea (the)	X		X	X	X	X
Dominican Republic (the)	X					
Ecuador	X	X			X	X
Egypt	X	X			X	X
El Salvador	X				X	
Eswatini					X	X
Fiji	X				X	
Ghana	X	X			X	X
India	X	X			X	X
Indonesia	X	X			X	X
Iran (Islamic Republic of)	X	X			X	X
Jamaica	X					
Jordan	X					
Kiribati	X	X			X	X
Malaysia	X	X		X	X	X
Mexico	X	X	X	X	X	X
Nicaragua	X					
Pakistan		X				X
Peru	X				X	

<sup>27</sup> Extracted from the TEAP Decision XXIX/10 Task Force report. The sources of information included: CLASP Policy Database (2018), <https://clasp.ngo/policies> (accessed on 15 August 2018); Kigali Cooling Efficiency Program, Africa Cooling Map, <https://www.k-cep.org/wp-content/uploads/2018/05/Africa-Cooling-map.pdf>; Braungardt S and Göthner KC, 2017. Harmonisation of MEPS and energy labelling in Latin America and the Caribbean – opportunities and challenges.

<sup>28</sup> Comparative labels allow consumers to compare similar products to each other using an energy efficiency rating on the label.

<sup>29</sup> Endorsement labels are granted if the product fulfils a set of criteria prescribed by the label.

Country	Comparative labels <sup>28</sup>		Endorsement labels <sup>29</sup>		MEPS	
	Refrigerator	Room AC	Refrigerator	Room AC	Refrigerator	Room AC
Philippines (the)	X	X				X
Saint Lucia	X	X				
Saudi Arabia	X	X				X
Solomon Islands	X	X			X	X
South Africa	X				X	X
Thailand	X	X	X	X	X	X
Tunisia	X	X			X	X
Turkey	X	X			X	X
Tuvalu	X	X			X	X
Uruguay	X	X				
Venezuela (Bolivarian Republic)	X	X				
Viet Nam	X	X	X	X		X

30. During implementation of HCFC phase-out, the Executive Committee has sought opportunities to promote energy efficiency improvements in the RACHP sector. In particular, the Committee approved 14 demonstration projects related to the introduction of low-GWP alternatives to HCFCs in different sectors. The promotion of energy efficiency improvements, and reports on the achieved energy efficiency performance were among the criteria used to select projects for funding.

31. Energy efficiency considerations influenced the approval of the conversion of the air-conditioning manufacturing sector in two countries. The HPMP for Jordan included a requirement that the air-conditioning sector plan would incorporate policy and technical approaches to improve the energy efficiency of residential air-conditioning equipment to offset the climate impact associated with the introduction of R-410A technology. The HPMP for Thailand included technical assistance to support promoting the adoption of energy-efficient products beyond those that were part of the conversion, and to support assisting energy-efficiency initiatives in buildings.

32. Even though energy efficiency policies are not within the responsibilities of NOUs, at its 82<sup>nd</sup> meeting (December 2018), the Executive Committee provided flexibility for Article 5 Parties engaged in enabling activities<sup>30</sup> to undertake the following activities using the funding already approved:<sup>31</sup>

- (a) Development and enforcement of policies and regulations to avoid market penetration of energy-inefficient RACHP equipment;
- (b) Promotion of access to energy-efficient technologies in those sectors; and
- (c) Targeted training on certification, safety and standards, awareness raising and capacity building aimed at maintaining and enhancing energy efficiency.

33. As mentioned in the TEAP Decision XXIX/10 Task Force report, it is important for national ozone officers (NOOs) to be aware of energy efficiency policies and targets in their countries that may affect their RACHP equipment and key trading partners, especially those countries that manufacture equipment or components. Cooperation among NOOs and the authorities responsible for energy efficiency, who have

<sup>30</sup> At its 79<sup>th</sup> meeting (July 2017), the Committee agreed to funding enabling activities to *inter alia* support: the phase-down of HFCs; the early ratification of the Kigali Amendment aimed at initiating supporting institutional arrangements; the review of licensing systems; HFC data reporting; demonstration of non-investment activities; and national strategies (decision 79/46). As of the 82<sup>nd</sup> meeting, 130 Article 5 countries had received funding for the implementation of enabling activities. Funding approved under enabling activities ranged from US \$50,000 for countries with HCFC baseline consumption of up to 0.8 ODP tonnes to US \$150,000 for countries with HCFC baseline consumption of 17.6 to 19.8 ODP tonnes.

<sup>31</sup> The impact of energy efficiency initiatives under enabling activities is not known and expected to be limited.

limited experience and a limited role in the adoption of low- or zero-GWP-based technologies, might result in reduced costs to manufacturers and might offer coordinated policy direction to meet national targets.

### **Maintaining energy efficiency in the servicing sector**

34. The normal wear-and-tear of any refrigerator or air-conditioning equipment during its lifetime affects the operation of the equipment, reduces its energy efficiency and increases energy consumption. Proper installation, maintenance and servicing practices play a critical role in minimizing wear-and-tear and ensuring the efficient operation of the equipment at the highest feasible energy efficiency over the life of the equipment. Servicing sector training activities could change operating practices of technicians, thereby ensuring energy efficient operation of equipment.

35. The TEAP Decision XXIX/10 Task Force report indicates that energy-efficient performance of RACHP equipment could be achieved, at low-to-medium cost levels, through the implementation of good servicing practices such as appropriate refrigerant and oil charge; good air circulation through the condenser; maintaining proper air flow through the evaporator; proper setting of the temperature sensor and of the thermostatic expansion valve; and proper setting of the condenser pressure control.

36. The performance of RACHP equipment associated with servicing and maintenance practices has been measured and published. Studies conducted by the United Kingdom of Great Britain and Northern Ireland, Australia and the European Partnership for Energy and the Environment report energy savings ranging from 8 per cent to 40 per cent or more, depending on the improvements or servicing practices involved, as shown below:<sup>32</sup>

- (a) A study by the Department of Environment, Food, and Rural Affairs of the United Kingdom of Great Britain and Northern Ireland, reported that cleaning a dirty condenser delivers an 8 per cent energy saving, and resetting the temperature set point to the design temperature yields an additional 11 per cent energy saving (Swain, 2009);
- (b) A study by the Government of Victoria in Australia found that improvements to technical elements of refrigeration and air-conditioning systems have the potential to reduce energy consumption by 15 to 40 percent; improving operational practices with minimal expense can often reduce energy costs by 15 per cent or more (Sustainability Victoria 2009);
- (c) The Chartered Institute of Building Services Engineers of the United Kingdom of Great Britain and Northern Ireland estimates that savings of around 15 per cent are achievable for residential buildings built according to standards and code; additionally, over 20 per cent of savings are achievable by following good practice guidelines; and
- (d) Examples of RACHP efficiency opportunities through improved operation and maintenance from the European Partnership for Energy and the Environment are presented in Table 2:

**Table 2. Examples of RACHP efficiency opportunities through improved operation and maintenance<sup>33</sup>**

<b>Action</b>	<b>Explanation</b>	<b>Impact</b>
No refrigerant leaks	Too low refrigerant charge increases compressor running time and eventual loss of capacity. Motor/compressors could eventually fail	+30 per cent energy consumption

<sup>32</sup> The TEAP Decision XXIX/10 Task Force report

<sup>33</sup> Presentation by Stefan Thie, EPEE Technical Expert, at the workshop on energy efficiency opportunities while phasing down HFCs.

Action	Explanation	Impact
Clean condenser and evaporator coils	Every 1K <sup>34</sup> rise in condensing temperature may reduce evaporator capacity by 1.35 per cent and increase power consumption A dirty evaporator coil would result in reduced system duty without a reduction in motor/compressor running current	+8 per cent energy consumption
Clean or replace filters regularly	Dirty filters would result in reduced system duty (2 - 4 per cent for every 1K reduction in evaporating temperature) without a reduction of compressor running current Filters with a too low filtration rate result in dirty cooling coils and fans	Average savings of 25 per cent
Check operations and settings of controller	Ensure that appropriate mode is being used, the temperature is set correctly (generally between 19 and 23 °C), a suitable fan speed is selected, the time schedule is correct and that each function operates correctly	Average savings of 97 per cent <sup>35</sup>
Check condenser pressure controls	Condenser fan cycling/speed controllers and dampers not set correctly could cause over- or under-condensing, resulting in poor efficiency and longer compressor running time Under-condensing would result in higher running currents	Average savings 4 per cent

37. The Multilateral Fund has supported training in good servicing practices for service technicians since the inception of the Fund; impact of the implementation of good servicing practices has not only reduced consumption of refrigerant, but also contributed to efficient operation of the RACHP equipment and maintained energy efficient performance of equipment. Training was initially provided as stand-alone training and has evolved to become an integral component of sector and/or national phase-out plans. In this process, NOUs have increased the involvement of national vocational/training centres in the implementation of training, and have ensured that the relevant subjects were included in the centres' curricula.

38. With the accelerated phase-out of HCFCs and the adoption of the Kigali Amendment, the number and variety of refrigeration and air-conditioning systems operating with low- or zero-GWP refrigerants has been increasing slowly. In this context, during the implementation of their HPMPs, several Article 5 countries have started strengthening the local institutions and bodies involved in technician training and certification; expanding the code of good practices and the training of technicians to include the proper handling and management of flammable and toxic refrigerants; and facilitating the introduction of low- or zero-GWP technologies in the RACHP sector.

### **Targeted training on certification, safety and standards, awareness raising and capacity building**

39. The level of funding for the implementation of HCFC phase-out plans in the refrigeration servicing sector for all Article 5 countries was established under decision 74/50. For LVC countries, the maximum funding levels were dependent on the HCFC baseline for compliance in the refrigeration servicing sector, and varied from US \$587,500 for countries with a consumption below 15 mt, to US \$1,800,000 for countries with a consumption above 320 mt. For non-LVC countries (with a consumption above 360 mt) funding was approved at US \$4.80/kg of HCFC used in the servicing sector.

40. With the funding provided, the activities covered under stages I and II of the HPMPs include, *inter alia*, support for the development of policy and regulations to facilitate the phase-out of controlled substances; training of customs and enforcement officers, including capacity building of these institutions

<sup>34</sup> Zero on the Celsius scale (0°C) is equivalent to 273.15K (°Kelvin), with a temperature difference of 1°C equivalent to a difference of 1K i.e., 100°C, defined as the boiling point of water, is equivalent to 373.15K. Every 1K temperature difference could result in higher power consumption impact during equipment operations.

<sup>35</sup> This value appears to be high. TEAP report indicates that controller settings adjustments would result in about 10 per cent savings.

for refrigerant identification; training of technicians in good service practices that often include safe adoption of flammable and toxic refrigerants; basic equipment and tools to support technicians and technical institutions in the adoption of good servicing practices; programmes for the recovery, reuse and reclamation of refrigerants; incentives for replacement or retrofit with alternative refrigerants; and information outreach and awareness activities.

41. Throughout the implementation of their HPMPs, Article 5 countries have the flexibility to select phase-out activities that are most suitable for the circumstances prevailing in their local markets and that best enable them to meet their compliance obligations. Several Article 5 countries have included schemes for the certification of servicing technicians, with most of them strengthening the training infrastructure to support the introduction of low- or zero-GWP refrigerants, with their intrinsic flammability and toxicity characteristics. A few Article 5 countries have also supported end-users, mainly through customized training programmes for technicians keeping in mind the market structure (e.g., large supermarkets planning to convert to low-GWP technologies have in-house capacity to maintain and train technicians), and through financial incentives for retrofitting and/or replacing the baseline equipment to low- or zero-GWP alternatives.

#### Certification of technicians

42. During the implementation of HPMPs, several Article 5 countries have considered it relevant to ensure the long-term sustainability of servicing sector activities by including systems for certifying the competency of technicians in good installation and servicing practices tailored to the specific circumstances of each country. Many countries have moved toward establishing voluntary certification schemes supported by regulations. An alternative approach considered in some countries is the issuing of environmental licenses, which would be under the purview of the Ministries of Environment. Some countries are strengthening the refrigeration associations and involving them more closely in implementing the certification system for technicians. In some regions (e.g., Pacific Island countries), there is a preference for using regional organizations for the certification of technicians as this could result in harmonised and cost-effective implementation of certification of technicians.

43. Establishing mandatory certification of technicians is more challenging, as such a decision would often go beyond the NOU's purview and would require additional institutional work. The extent to which certification mechanisms serve as a "pre-condition" for technicians varies when it comes to following procedures for good servicing of RACHP equipment, the procurement and use of different types of refrigerants, the recovery and reuse of refrigerants and the safe/effective disposal of equipment. In some countries, there are specific bodies in charge of developing technical norms and certification processes; technicians obtain a competency-based certification issued by the relevant education or other relevant regulatory body (e.g., labour ministry, technical education department) within the Government.

44. To ensure long-term sustainability of the certification of technicians, certification systems need to be further developed and/or strengthened with necessary regulatory measures at national level. The training curricula of institutions and vocational schools should be periodically updated to incorporate changes, technology upgrades of RACHP systems and the introduction of alternative refrigerants. Consideration should be given to: extending certification to enterprises involved in the installation, servicing, maintenance and decommissioning of RACHP equipment; linking technician certification to regulatory norms or standards adopted by the country; determining the number and levels of technician certification according to the specific needs of the country; and strengthening and involving refrigeration associations in the promotion or implementation of technician certification. The certification programme should include regulations to prevent uncertified technicians from working on and/or servicing RACHP equipment with certain technologies, and purchasing and handling refrigerants, and should be supported by information outreach and awareness to ensure its sustained adoption.

Safety and standards

45. As more low- or zero-GWP alternative refrigerants enter the markets in Article 5 countries, the training infrastructure currently used for phasing out HCFCs should be assessed to determine whether it would need to be further strengthened or updated. Similarly, the current training programmes must be reviewed in order to extend the good servicing and maintenance practices to cover the new technologies being introduced. They should be structured based on national priorities relating to the servicing sector's capacity and the technologies that are expected to be introduced while phasing out HCFCs.

46. Adapting internationally approved standards<sup>36</sup> to suit national requirements could be a cost-effective way of adopting standards. In the context of LVC countries, equipment standards would typically be adopted from the prevailing international standards and adapted to the extent required to suit local conditions. Servicing standards, however, need to be developed and integrated with the certification system to ensure sustainable adoption of equipment using low-GWP alternatives.

Awareness raising and capacity building

47. Awareness-raising activities are carried out in LVC countries under HPMPs and as part of the institutional strengthening project, mainly to support the phase-out of controlled substances in line with the compliance targets of the Montreal Protocol. Energy efficiency-related awareness activities are not separately covered under HPMPs, though they at times are covered under training activities for the servicing sector.

48. Capacity building for implementation of the Montreal Protocol has been funded since the inception of the Multilateral Fund directly to each Article 5 country, to UNEP CAP through its clearinghouse function, and at the regional and global levels, mainly through regional network meetings. The list of tools developed by UNEP CAP<sup>37</sup> and other relevant tools developed by different implementing agencies can be used to develop certification programmes in a cost-effective manner, tailored to country-specific technical needs.

49. Capacity building activities relating to regulations, training and institutional coordination with energy efficiency authorities are essential for facilitating the adoption of low- and zero-GWP refrigerants. These activities need to be customized based on national needs and priorities. Integrating energy efficiency-related aspects into outreach programmes can effectively disseminate information on energy issues to various stakeholders.

**Criteria, performance indicators, and associated funding mechanisms of servicing sector plans in existing or new HPMPs**

50. The Secretariat's review of the regulatory framework and the phase-out plans for controlled substances, in particular those related to the refrigeration servicing sector, in light of decision 82/83(c) has led to the understanding that introducing low- or zero-GWP technologies and maintaining the energy efficiency of RACHP equipment in the refrigeration servicing sector would necessitate the following:

- (a) Strengthening existing policies and regulations, and developing new ones for the staged reduction of imports of HCFC-based RACHP equipment, and for the adoption of

<sup>36</sup> The international bodies responsible for RACHP standards are the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC). In addition, there are national and regional level standard bodies.

<sup>37</sup> The tools, products and services provided by UNEP CAP are described in Annex III of document UNEP/OzL.Pro/ExCom/82/64.

energy-efficient equipment based on low- or zero-GWP refrigerants while phasing out HCFCs;

- (b) Coordination with energy efficiency policy makers in setting up and/or operationalizing MEPS, labelling systems and other mechanisms for the introduction of energy-efficient RACHP equipment (preventing the introduction of energy-inefficient low- and zero-GWP refrigerant-based RACHP equipment) into local markets;
- (c) Continued implementation of standards for safety and for the effective use of low- or zero-GWP refrigerants, and the development and implementation of regulations to ensure that only certified technicians service and maintain RACHP equipment and handle all types of refrigerants;
- (d) Continued training and certification of technicians in the installation, maintenance and servicing of RACHP equipment to ensure efficient and safe operation of the equipment throughout its lifetime, and demonstration of new low- and zero-GWP refrigerant-based technologies; and
- (e) Awareness and information outreach on the adoption of low- or zero-GWP energy-efficient technologies, and on the certification of technicians.

51. Given that most of the above-mentioned activities for facilitating the adoption of low- or zero-GWP technologies while phasing out HCFCs are currently being implemented under stages I and II of the HPMPs, operationalizing paragraph 16 of decision XXVIII/2 would involve identifying activities in addition to the existing activities under HPMPs. Activities relating to the introduction of energy-efficient RACHP equipment are being implemented as part of the enabling activities, albeit to a limited extent. The results of the outcomes of these activities have yet to be reported.

52. Based on the above considerations, the extent to which additional funds are required would depend upon the levels of additional activities to be implemented under existing stages or future stages of HPMPs. These could include the following, for countries not already implemented such activities:

- (a) Pilot projects strategically designed and targeted to end-users, primarily for small capacity RACHP equipment, for adoption of energy-efficient equipment operating with low- or zero-GWP refrigerants for which manufacturing conversion projects have been funded under the HPMP and challenges are experienced in market acceptance;
- (b) Updating training material to strengthen components relating to good practices for installation, maintenance and servicing of RACHP equipment based on refrigerants with different operating characteristics in regard to flammability, toxicity and pressure;
- (c) Coordination and collaboration between the NOU and the energy efficiency authorities to support the development and enforcement of MEPS, labelling programme and standards for the introduction of energy-efficient RACHP equipment based on low- and zero-GWP refrigerant technologies;
- (d) Development and enforcement of certification schemes for technicians and strengthening infrastructure of national institutions on implementing certification systems. In particular, this is required due to the flammable or toxic characteristics of the low and zero-GWP refrigerants; and

- (e) Awareness and outreach programmes to promote the introduction of MEPS and labelling systems; mandatory certification of technicians; and introduction of energy efficiency RACHP equipment operating with low- and zero-GWP refrigerants.

53. Currently, HPMP activities in LVC countries are funded in line with decision 74/50(c)(xii), as shown in Table 3.

**Table 3. Total funding approved for HPMP and enabling activities in LVC countries (US \$)**

Consumption (mt)	Up to 2020	Up to 2025	Total phase-out
0-15	205,625	396,500	587,500
15-40	262,500	506,250	750,000
40-80	280,000	540,000	800,000
80-120	315,000	607,500	900,000
120-160	332,500	641,250	950,000
160-200	350,000	675,000	1,000,000
200-320	560,000	1,080,000	1,600,000
320-360	630,000	1,215,000	1,800,000

54. Additional funding needs for achieving the objectives of decision 82/83(c), would depend upon the design of stage II of the HPMPs in terms of activities that would facilitate adoption of low- and zero-GWP alternatives and maintaining energy efficiency. With the existing levels of funding under decision 74/50 and with suitable realignment of activities, technician training and awareness outreach activities could also be undertaken for adoption of low- and zero-GWP alternatives.<sup>38</sup>

55. The need for incremental activities would mainly arise to address coordination of NOU with institutions/authorities handling energy efficiency matters to ensure energy efficiency regulations are integrated with establishment of national standards for adoption low- and zero-GWP technologies; and strengthening certification infrastructure for safe adoption of low- and zero-GWP technologies. These incremental activities will facilitate achievement of HCFC phase-out in a sustainable manner and would build a platform for HFC phase-down activities.

56. For new HPMPs or new stage of HPMPs, the countries could submit additional funding requests based on incremental levels of funding to be agreed along with associated conditions for the above-mentioned activities. For already approved stage II of HPMPs, the additional funding and associated conditions, would be considered based on the revised plans while submitting the next funding tranche.

57. Performance indicators are linked to specific actions that are considered for implementation. The following performance indicators, with suitable additions/modifications, could be adopted to measure the implementation of specific policies:

- (a) Number of policies and regulations developed and enforced for reducing and prohibiting import of HCFC-based RACHP equipment, and favouring the introduction of equipment based on low- and zero-GWP refrigerants;
- (b) Number of policies and regulations, such as MEPS and labelling systems, favouring the introduction of energy-efficient RACHP equipment;
- (c) Status of implementation of standards and labelling programmes for RACHP equipment based on low- and zero-GWP technologies;

<sup>38</sup> Pilot end-user incentive programmes and their impact would be analysed and presented in a separate paper to the 84<sup>th</sup> meeting.

- (d) Number of training institutions with infrastructure to train and certify technicians in good practices during installation, servicing and maintenance covering all types of RACHP equipment available in the country;
- (e) Number of training programmes conducted that include installation, servicing and maintenance of low and zero-GWP refrigerants, and number of technicians trained and integrated into training programs in the training institutions;
- (f) Status of enforcement of certification systems for servicing technicians;
- (g) Funds approved and disbursed for pilot end-user incentive programme and the ODS phase-out impact while adopting the technology;
- (h) Number of awareness and outreach programmes conducted favouring the introduction of MEPS and labelling systems; mandatory certification of technicians; and introduction of energy-efficient RACHP equipment operating with low- and zero-GWP refrigerants; and
- (i) Results of reports on monitoring, and reporting of activities undertaken and feedback received from NOUs and other national stakeholders on the impact of these programmes.

### **Recommendation**

58. The Executive Committee may wish to note the paper on ways to operationalize paragraph 16 of decision XXVIII/2, and paragraph 2 of decision XXX/5 of the Parties, taking into account the criteria, performance indicators, and associated funding mechanisms of servicing sector plans in existing or new HCFC phase-out management plans for low-volume-consuming countries, contained in document UNEP/OzL.Pro/ExCom/83/40.

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