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THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
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Item 10(b) of the provisional agenda[1]

# OPERATIONAL FRAMEWORK TO FURTHER ELABORATE ON INSTITUTIONAL ASPECTS AND PROJECTS AND ACTIVITIES THAT COULD BE UNDERTAKEN BY THE MULTILATERAL FUND FOR MAINTAINING AND/OR ENHANCING THE ENERGY EFFICIENCY OF REPLACEMENT TECHNOLOGIES AND EQUIPMENT IN THE MANUFACTURING AND SERVICING SECTORS WHEN PHASING DOWN HFCs: A REPORT ON DECISION 92/38(a)

## Introduction

1. The Executive Committee requested the Secretariat to develop a report for its consideration at the 93rd meeting containing (i) any additional activities to maintain and/or enhance energy efficiency while phasing down HFCs beyond those listed in paragraph (b)(i) of decision 91/65; (ii) information on additional costs and savings while implementing those activities taking into account the payback associated with the use of energy-efficient equipment and other benefits to the consumer; (iii) options for funding modalities in the Multilateral Fund (MLF) as well as possible implications of their operation; (iv) updated information on the role of other institutions addressing energy efficiency, where appropriate; and (v) a proposed methodology for monitoring and reporting on the progress of projects to maintain and/or enhance the energy efficiency of replacement equipment in the HFC phase-down, taking note of relevant methodologies, where appropriate (decision 92/38).

2. In preparation of this report, the Secretariat consulted technical and financial experts on project activities relating to energy efficiency in refrigeration, air-conditioning and heat-pump (RACHP) applications, industry personnel dealing with RACHP equipment, and bilateral and implementing agencies. The Secretariat also reviewed the reports of the Technology and Economic Assessment Panel (TEAP) energy efficiency working group on energy-efficiency-related costs and funding modalities and the outcomes of the workshop on energy efficiency organized by the Ozone Secretariat on 22 October 2023 in Nairobi, Kenya.

[1] UNEP/OzL.Pro/ExCom/93/1

3. The report is divided into three distinct chapters:

(a) **Chapter 1**: Operational framework with MLF grant funding. This chapter presents details of the assumptions relating to the operational framework with MLF funding for additional activities relating to energy efficiency while phasing down HFCs, pursuant to decision 92/38; alternative funding modalities for energy efficiency for the different investment and non-investment activities identified, conditions associated with funding for energy-efficiency activities and monitoring and reporting of project performance;

(b) **Chapter 2**: Operational framework with blended finance from MLF and non-MLF resources. This chapter presents the details of a revolving fund that could be considered as an option for the implementation of energy-efficiency-related activities while phasing down HFCs, and two case studies that illustrate how multiple sources of funding can be integrated to implement energy efficiency components while phasing down HFCs; and

(c) **Chapter 3**: Summary and recommendation.

# CHAPTER 1: OPERATIONAL FRAMEWORK WITH MLF GRANT FUNDING

## Part I: ASSUMPTIONS/KEY CONSIDERATIONS AND ADDITIONAL ACTIVITIES RELATED TO THE OPERATIONAL FRAMEWORK

### I.1 Assumptions and key considerations related to the operational framework

4. When reading the present report, Executive Committee members should take into consideration the following assumptions:

(a) Energy efficiency is not compliance-related under the Montreal Protocol. Therefore, in line with relevant Executive Committee decisions, incentives and costs for additional activities could be provided based on their high impact in the context of HFC-phase down.

(b) The energy-efficiency-related activities[2] currently being considered by the Executive Committee and/or implemented with assistance from the MLF, will further strengthen energy efficiency related policies over time and cost-guidance of energy efficiency in the context of the HFC phase-down.

(c) The additional costs associated with energy efficiency in the context of the HFC phase-down may be decreasing over time, mainly because of decrease in costs of energy-efficient components due to more cost-effective design, greater supply and the "learning curve" in design and manufacturing processes for those components resulting in cost reductions. Inputs from industry experts indicate that though there appears to be a decreasing trend in the costs of components,[3] predicting their costs over the next three to five years is difficult as other factors such as inflation, supply-chain challenges that are country specific, and structural factors that affect commercial arrangements between equipment manufacturers and component suppliers in different countries could impact the cost of components; this could result in higher costs associated with adoption of energy efficient components.

(d) The Secretariat, in this report, has presented information on best estimates of the cost of components from industry experts. These estimates could vary depending upon factors such as the manufacturing volume of different equipment, commercial contractual terms, business strategy and the relationships between equipment suppliers and component manufacturers. The cost of components can also vary depending on the equipment's capacity and different models.

(e) Energy efficient operations of the equipment would result in lower indirect emissions from energy generation. It is, however, difficult to correlate energy savings with the indirect emissions without having a full assessment of the usage characteristics of the products in different markets (e.g., manufacturing of an energy efficient equipment in a country with high grid-emission factor would result in less carbon emission savings if the equipment were exported to a country with low grid-emission factor). Therefore, energy consumption savings in kWh could be considered as the metric for transitioning to energy efficient equipment.

(f) Low-global-warming-potential (GWP) alternatives are available and have been extensively adopted by the industry for some applications (e.g., domestic refrigerators, self-contained

[2] Activities relating to energy efficiency pursuant to decision 89/6 have been approved over the last 12 months only and those pursuant to decision 91/65 are being considered from the 93rd meeting.
[3] TEAP energy efficiency task force report, May 2023.

commercial refrigeration). In developing the present document, the Secretariat took this into account so as to maximize the climate benefit, to the extent possible, when looking at an integrated approach between maintaining and/or enhancing energy efficiency while phasing down HFCs.

(g) The present report makes specific reference to small and medium-sized enterprises (SMEs). Defining such enterprises is subject to discussions and decisions of the Executive Committee under the cost funding guidelines.[4]

## I.2 Any additional activities to maintain and/or enhance energy efficiency while phasing down HFCs beyond those listed in paragraph (b)(i) of decision 91/65

5. Paragraph (b)(i) of decision 91/65, as set out in the annex to this document, includes a set of activities that can be considered for funding pilot projects to maintain and/or enhance energy efficiency while phasing down HFCs. Based on additional information available from the TEAP task force's reports on energy efficiency, information from technical experts and agencies, and information provided during consultations on matters relating to energy efficiency during the 89th to the 92nd Executive Committee meetings, the following additional activities have been identified:

(a) Support for manufacturing energy-efficient compressors and heat-exchangers for low-GWP energy-efficient equipment[5] as this would help the accelerated adoption of energy-efficient equipment.

(b) Regional/national centres for testing domestic refrigerators, commercial refrigeration equipment and residential and commercial air-conditioners, including support for updating existing centres, supported by a sustainable business model to strengthen the monitoring and enforcement capacities of energy-efficiency standards for RACHP equipment, particularly for those countries that are dependent on imports.

(c) Regional centres of excellence for the adoption of energy-efficient technologies at SMEs that manufacture equipment, that undertake local installation and assembly, and through the training and capacity building of national stakeholders on maintaining and/or enhancing energy efficiency of equipment, developing energy efficiency regulations, and monitoring energy efficiency. These regional centres will have an impact on the cost-effective delivery of capacity-building programmes and on the accelerated adoption of energy-efficient components and equipment.

(d) Feasibility analysis and information outreach on district cooling that would result in the adoption of energy-efficient technologies. Implementing these projects would necessitate strong Government support and commitment from the entities (e.g., local operations and maintenance contractor for a large commercial complex) providing this service.

(e) Feasibility analysis for retrofitting large refrigeration and air-conditioning (RAC) systems with energy-efficient alternative-refrigerant-based systems that would result in more energy-efficient equipment performance, reducing long-term dependence on energy-inefficient equipment and leading to the widespread adoption of energy-efficient low-GWP-refrigerant-based large RAC systems. Implementing these projects would

[4] UNEP/OzL.Pro/ExCom/93/96

[5] Since these two components are important for maintaining and/or enhancing energy efficiency while phasing down HFCs for RAC equipment manufacturing.

necessitate strong Government support and commitment from the end-users for implementing this project.

6. The Secretariat also recognises that there could be other innovative projects that may be identified by bilateral and implementing agencies based on national or regional needs, which should be evaluated on a case-by-case basis (e.g., new products such as tumbler dryers, demonstration projects of innovative low-GWP technologies). It is expected that such projects would be submitted in the context of HFC phase-down and would result in maintaining and/or enhancing energy efficiency while phasing down HFCs.

## Part II: FUNDING MODALITIES IN RELATION TO GRANT FUNDING

### II.1 Incentive-based and activity-output-based funding

7. For the implementation of the project activities identified above, two options are proposed: an incentive-based approach and an activity-output-based approach. Under the incentive-based approach, there are two kinds of funding support that would be available to the beneficiaries – the first relating to up-front funding for certain activities, typically investment activities,[6] and the second relating to an incentive for achieving enhanced energy-efficiency performance, which would be linked to energy-efficiency targets compared to the baseline situation of the beneficiary. The latter would be paid upon satisfactory achievement of those targets. The incentive-based approach helps end users save on the cost of energy-efficient equipment; the manufacturers would be compensated for initial high costs, thus encouraging them to adopt energy-efficient technologies when phasing down HFCs. Details of how this incentive-based approach would work is explained in the sections below for different categories of equipment.

8. Under the activity-output-based approach, the funding support would be provided based on specific output(s) and outcome indicators identified for project implementation; while most of the funds approved would be paid up-front, a small proportion would be paid upon satisfactory reporting on project activity output and outcome indicators.

9. The incentive-based approach is proposed only for manufacturers of equipment whereas the activity-output-based approach is proposed for all other activities.

### II.2 The principles of designing an incentive-based approach

10. The parameters to be taken into consideration while designing an incentive-based funding modality are given below:

(a) **The incentive to the beneficiary (e.g., enterprise manufacturing air-conditioners) should make transitioning to equipment with higher energy efficiency attractive**: The energy-efficiency levels achieved through the project should be higher than the "business-as-usual" levels and should be closely linked to the additional cost to the enterprises of achieving those higher levels of energy efficiency and lower levels of energy consumption;[7]

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[6] These activities can also be paid for based on levels of manufacturing volumes or other activity drivers that have a bearing on the levels of funding needed. As mentioned later in the document, combining activities relating to energy efficiency and HFC phase-down could result in reduction in these costs.

[7] For equipment in the refrigeration sector, energy consumption per year would be used for determining performance (i.e., **the lower the energy consumption per year**, the higher the performance). For equipment in the air-conditioning sector, the seasonal energy efficiency ratio or equivalent would be used for determining performance (i.e., the **higher the seasonal energy efficiency ratio**, the higher the performance)

(b) **Higher levels of incentive would be provided for higher energy-efficiency performance improvements compared to the baseline**: For example, an enterprise that chooses to adopt a better than "business-as-usual" energy-efficiency level that is higher than that of another enterprise with a similar baseline should receive a higher incentive;

(c) **The incentive mechanism should be linked to timing of the project implementation**: If a project is delayed, the energy-efficiency levels achieved by the industry by the time of completion of the project could be higher than what was originally planned under the project. The incentive mechanism should have safeguards to ensure timely project implementation and not provide incentives for business-as-usual improvements in energy efficiency;

(d) **The incentive mechanism should be linked to promote adoption of refrigerants that are not controlled substances, where feasible**:[8] For example, in domestic and stand-alone commercial refrigeration applications where refrigerants that are not controlled substances are proven and available, the incentive would be available for adoption of energy efficient non-HFC refrigerant technologies;

(e) **Co-financing**: Enterprises that would avail of the incentives in line with the Executive Committee guidelines would also need to provide co-financing for successful implementation of the project; their business strategy and pace of consumer adoption would determine levels and duration of such co-financing. A combination of incentive and co-financing would promote faster sustained adoption of energy-efficient technologies while phasing down HFCs;

(f) **Reduction observed in the price of components over time should be considered in defining the incentive mechanisms**: The incentive levels need to be linked to the cost of the components, as high component prices to the equipment manufacturers act as a barrier to the supply of energy-efficient equipment; the price of some of the components is fast decreasing[9] and is primarily driven by higher manufacturing volumes of those products. In addition, the pricing strategy followed by component manufacturers in different markets also determines local prices. The incentive levels should have necessary "adjustments" for such a decrease in the price of components over time, to the extent feasible;

(g) **Payback to consumers using energy efficient equipment**: Energy efficiency in RACHP equipment results in payback to the end-users because of savings in energy consumption. The levels of payback primarily depend on usage characteristics, the price of electricity, and the additional cost of such energy efficient equipment. While the manufacturers of equipment indirectly benefit from payback (i.e., higher sales of energy-efficient equipment which could be higher in price), they do not directly obtain any gains from higher payback. At the initial stages of adoption of energy efficient technologies, higher price of components results in lower profits to the manufacturers of equipment, and this is a barrier in faster adoption of those technologies. This needs to be taken into account when defining incentives for manufacturers to manufacture energy-efficient equipment;

(h) **Type of funding support should be simple to implement:** The processes relating to funding support should be simple and should be based on the performance of the equipment covered under the project**;** the monitoring and evaluation methodology should be simple and should easily assess the performance of the project compared to the baseline level and

[8] Feasibility would be largely determined while developing the Kigali HFC implementation plan for the country and would be based on product market trends for such non-HFC based technologies.
[9] Figure 9.1, TEAP energy efficiency working group report, May 2023

minimize any administrative burden for the industry and other stakeholders managing the project;

(i) **Supporting policy and regulations by Government:** This should be an integral part of project implementation and a precondition for any funding provided; policy and regulations are needed to sustain energy-efficiency improvements, provide the right market signals for accelerated adoption of energy-efficient products and demonstrate the results of those improvements; for example, the commitment of energy-efficiency authorities or their equivalent could be secured by making the approval of the project conditional on those authorities' inclusion in project planning and implementation monitoring.

11. Energy-efficiency-related activities in the context of HFC phase-down can be implemented in a range of RACHP equipment through a combination of interventions such as equipment redesign and testing, the use of components that result in energy efficiency while using the equipment, capacity building including training and technical assistance, awareness and information outreach, and other energy-efficiency infrastructure interventions. For the purpose of this report, the interventions are divided into the following categories with their corresponding funding modalities as shown in table 1.

**Table 1. Overview of type of funding support for different interventions**

| Interventions | Specific sectors | Funding modality | Remarks |
|---|---|---|---|
| <u>Investment</u><br>Manufacturing of equipment | Domestic refrigeration equipment<br>Self-contained commercial refrigeration equipment<br>Residential AC equipment<br>Commercial AC equipment | Incentive-based | • Up-front additional capital investment<br>• Incentive based on achieving specific energy efficiency targets |
| <u>Investment</u><br>Manufacturing of component* | Compressors and heat-exchangers (Fin and tube Heat-exchangers (FTHX)<br>Microchannel heat-exchangers (MCHX) | Activity-output-based | • Portion of total funding paid up-front<br>• Remaining paid on achievement of project activity output indicators |
| <u>Non-investment</u> | Technical assistance for SMEs and for local assembly and installation/service sector support/support for testing centres and centres of excellence | Activity-output-based | • Percentage (e.g., 70-90 per cent) of total funding paid up-front to the country<br>• Remaining paid on achievement of project activity output indicators |
| | Support for feasibility studies for district cooling and studies for retrofitting equipment using energy-efficient technologies/ energy-efficiency project preparation funding | Activity-output-based | 100 per cent up-front payment to the country |

*This would include only capital investment costs.

12. For other categories of equipment and/or project activities, the relevant project proposals will be considered on a case-by-case basis taking into consideration the impact of such activities in the context of the HFC phase-down.

## Part III: INVESTMENT ACTIVITIES

### III.1 Manufacturing of equipment

#### III.1.1 Incentive-based approach in the manufacturing of equipment, including by SMEs

13. The following methodology is proposed for providing incentives to equipment manufacturers to manufacture energy-efficient equipment while phasing down HFCs.

(a) The baseline energy efficiency[10] of the equipment covered by the project would be assessed based on the energy efficiency of the same type of equipment produced the previous year. To account for business-as-usual energy-efficiency improvements in the industry, the energy efficiency levels for the project will be compared with the industry average at the time of project completion. The beneficiaries need to consider accounting for business-as-usual performance improvements for the specific application during project preparation and extrapolating the baseline performance to those levels; these extrapolated performance levels would be used during project review;

(b) The proposed energy-consumption/energy-efficiency targets would be defined for each category of equipment covered under the project and aggregated based on the volume manufactured in each category. The average energy efficiency for each category of equipment once the project is completed, will be the weighted average of energy efficiency of all equipment covered in the project;[11]

(c) An enterprise may choose a specific type of equipment to be covered under the project (e.g., equipment with greater than or less than a specific capacity). This can result in challenges in ensuring the sustainability of the project unless there is a joint commitment from the enterprise and the Government that the enterprise would continue to manufacture all equipment covered under the project at least at the agreed energy-efficiency levels; further, the Government would need to establish minimum energy-efficiency standards at the target energy-efficiency levels for that equipment to ensure sustainability of the target energy-efficiency levels;

(d) A synchronised implementation of energy efficiency interventions with refrigerant conversion projects, i.e., as part of Kigali HFC implementation plans (KIPs) or as individual project for HFC consumption reduction, would lead to savings compared to separately implementing refrigerant conversion and energy efficiency (annex to document UNEP/OzL.Pro/ExCom/91/64); it would also allow Article 5 countries to develop comprehensive policies to support implementing energy efficiency measures while phasing down HFCs and work closely with their local industry; and

(e) The levels of incentives to be provided to the equipment manufacturer would be determined by comparing the equipment's baseline energy efficiency levels and the proposed target energy efficiency levels that would be achieved after implementation of the project.

14. The cost range for investment costs for different equipment provided in tables 2 to 6 is based on best estimates for interventions relating to product design and development and training. Product design,

[10] In case of refrigeration equipment, lower energy consumption would result in higher energy efficiency.

[11] The weighted average energy efficiency will be calculated as the product of the number of units of equipment manufactured and sold in the different categories of equipment and the energy-efficiency target levels for each category divided by the total quantity of the units of all equipment manufactured and sold by the enterprise.

development and testing would relate to costs of the engineering team whereas training would relate to costs of training the technical and plant personnel.

### III.1.2 Domestic refrigeration

15. Domestic refrigeration equipment is used mainly in households, small shops and establishments, hotels and other similar users for storing products requiring refrigeration. This equipment uses compressors driven by motors with a capacity of less than 1/3 hp.[12] The capacity of the equipment can be higher than 1,000 litres, depending on the markets, though most of the equipment sold globally would have a much lower capacity.

16. Additional costs for energy efficiency while phasing down HFCs would include additional capital investment costs and additional component costs for energy-efficient equipment while phasing down HFCs (see table 2). Additional capital investment costs are those up-front investments needed for manufacturing energy-efficient equipment (e.g., investments in product design and development including prototype development and testing, investments in training of technical personnel). Additional component costs are defined as those additional costs for achieving better energy-efficient performance through alternative components for the same equipment (e.g., variable speed compressors, energy-efficient heat exchangers).

**Table 2. Additional costs[13] for domestic refrigeration for an enterprise with a capacity of 250,000 units per annum**

| **Additional capital investment costs at an enterprise level** | | | |
|---|---|---|---|
| **Interventions** | | **Costs in US $** | |
| Product design and development | | 200,000 - 400,000 | |
| Training in energy-efficient product technology/design | | Nil - 50,000 | |
| **Total costs** | | **200,000 – 450,000** | |
| **Additional component costs for achieving different energy-efficiency levels at the unit level i.e., a unit of domestic refrigeration equipment with a capacity of 300 litres** | | | |
| **Energy consumption of the unit per year (kWh/year) at a baseline level** | Additional cost per unit if the unit moves to "low" energy-efficiency performance[14] i.e., 275 kWh/year | Additional cost per unit if the unit moves to "medium" energy-efficiency performance i.e., 225 kWh/year | Additional cost per unit if the unit moves to "high" energy-efficiency performance i.e., 200 kWh/year |
| Greater or equal to 320 kWh/year | 7.00 | 15.80 | 20.00 |
| Greater or equal to 250 and less than 320 kWh/year | NA | 8.80 | 13.00 |
| Greater or equal to 200 kWh/year and less than 250 kWh/year | NA | NA | 4.80 |

Assumptions: (1) If the manufacturing capacity is lower (e.g., 100,000 units per annum.), the additional capital investment costs would be lower. However, as manufacturing capacity and investment costs decrease, component costs may increase due to lower manufacturing capacity; (2) The enterprise sources the key components and **does not** manufacture these components within their own manufacturing plant / related manufacturing units; (3) Increasing the foam thickness to improve thermal insulation is included as an energy-efficiency measure due to the additional cost

[12] 1 horsepower (hp) is equal to 0.745 kW.

[13] All costs are best estimates and are based on inputs from industry and technical experts.

[14] Medium–variable speed compressor, heat exchangers, additional insulation foam (***partial enhancement***) for partial reduction in heat transfer into the equipment and improved fans and motors; high–variable speed compressor, heat exchangers, additional insulation foam (***full enhancement***) for greater reduction in heat transfer into the equipment and improved fans and motors.

involved for the new formulations;[15] (4) This represents the additional component costs for conversion to different levels of energy consumption specified in the table; this assumes that the baseline equipment does not have any interventions implemented relating to energy efficiency and addresses only the conversion of refrigerant; (5) The target energy-efficiency levels shown in the table above are based on the United for Efficiency model regulations.

17. From the previous table, the following conclusions could be derived:

(a) The total cost, including investment and component costs, to enhance energy efficiency to the “low” level is US $2.20 million[16] for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above. There may be some cases, due to national circumstances, that incentive may be granted to transition to a “low” level energy efficiency, though this is expected to be on an exceptional basis.

(b) The total cost, including investment and component costs, to enhance energy efficiency to the “medium” level is US $4.40 million for an enterprise with equipment at the lowest baseline energy efficiency.

(c) The total cost, including investment and component costs, to enhance energy efficiency to the “high” level is US $5.45 million for an enterprise with equipment at the lowest baseline energy efficiency.

(d) With **an incentive, for example, of 25 to 50 per cent of the total cost of components**, the total incentive level paid to the enterprise would be within the range of US $1.70 million to US $2.95 million for a transition from the lowest level of baseline energy efficiency of the enterprise to the highest level of target performance to be achieved by the enterprise (as referred in subparagraph 17(c)). The rest will be paid through co-financing from the enterprise and non-MLF resources.

### III.1.3 Self-contained commercial refrigeration equipment

18. Commercial refrigeration equipment may be divided into multiple configurations, for example, refrigerated display coolers including bottle coolers, visi-coolers, display cabinets, and refrigerated storage cabinets including chest freezers and other similar equipment. This equipment uses compressors driven by motors with a capacity of 1/3 hp to 3 hp. The capacity of the equipment varies, and in many instances, is procured and maintained by large commercial brands of food and beverage products. A range of interventions and additional components may be needed to achieve higher levels of energy efficiency.

19. Additional capital investment and component costs are expected to be incurred for maintaining and/or enhancing energy efficiency while phasing down HFCs. The estimates of additional capital and component costs for a plant with a capacity of 100,000 units per annum is given below; the plant capacity in these applications can have large variations due to the presence of many small-scale enterprises manufacturing equipment. For the purpose of this report, two categories of commercial equipment that are predominantly sold in many markets, namely chest freezers and refrigerated display cases, are considered for the assessment of additional costs. Table 3 provides the additional costs for a plant that manufactures 100,000 chest freezers per year with a capacity of 300 litres. Table 4 provides the additional costs for a plant that manufactures 100,000 refrigerated display cases per year with display area of 2.5 $m^2$.

[15] While implementing energy-efficiency improvements, the formulation of PU foam/ design of insulation foam may also need to change. These costs are included in cost estimates given in table above.
[16] This has been calculated as the total of additional capital investment costs and the product of number of units manufactured and the additional cost per unit. For example, US $2.2 million = US $0.45 million + US $1.75 million (250,000 x US $7).

**Table 3. Additional costs for commercial refrigeration for a plant manufacturing 100,000 chest freezers per year**

| **Additional capital investment costs at an enterprise level** | | | |
|---|---|---|---|
| **Interventions** | | **Costs in US $** | |
| Product design and development | | 150,000 - 250,000 | |
| Training in energy-efficient product technology/design | | Nil - 50,000 | |
| **Total costs** | | **150,000 - 300,000** | |
| **Additional component costs for achieving different energy-efficiency levels at the unit level i.e., a chest freezer equipment with capacity of 300 litres** | | | |
| **Energy consumption of the unit per year (kWh/year)** | Additional cost per unit if the unit moves to "low" energy-efficiency performance[17] i.e., 4,000 kWh/year | Additional cost per unit if the unit moves to "medium" energy-efficiency performance i.e., 3,500 kWh/year | Additional cost per unit if the unit moves to "high" energy-efficiency performance i.e., 2,000 kWh/year |
| Greater or equal to 5,000 kWh/year | 7.00 | 15.80 | 20.00 |
| Greater or equal to 3,500 and less than 5,000 kWh/year | NA | 8.80 | 13.00 |
| Less than 3,500 kWh/year | NA | NA | 4.80 |

Assumptions: (1) If the manufacturing capacity is lower (e.g., 40,000), the additional capital investment costs would be lower. However, as manufacturing capacity and investment costs decrease, component costs may increase due to lower manufacturing capacity; (2) The enterprise sources the key components and **does not** manufacture these components within their own manufacturing plant/related manufacturing units; (3) Increasing the foam thickness to improve thermal insulation is included as an energy-efficiency measure due to the additional cost involved for the new formulations;[18] (4) This represents the additional component costs for conversion to different levels of energy consumption specified in the table; this assumes that the baseline equipment does not have any interventions implemented relating to energy efficiency and addresses only the conversion of refrigerant; (5) The target energy-efficiency levels shown in the table above are based on the United for Efficiency model regulations.

20. From the previous table, the following conclusions could be derived:

(a) The total cost, including investment and component costs, to enhance energy efficiency to the "low" level is US $1.0 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(b) The total cost, including investment and component costs, to enhance energy efficiency to the "medium" level is US $1.88 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(c) The total cost, including investment and component costs, to enhance energy efficiency to the "high" level is US $2.30 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(d) With **an incentive, for example, of 25 to 50 per cent of the total cost of components**, the total incentive level paid to the enterprise would be within the range of US $0.80 million to US $1.30 million, at the lowest level of baseline energy efficiency and the highest level

[17] Medium–variable speed compressor, heat exchangers, additional insulation foam (***partial enhancement***) for partial reduction in heat transfer into the equipment and improved fans and motors; high–variable speed compressor, heat exchangers, additional insulation foam (***full enhancement***) for greater reduction in heat transfer into the equipment and improved fans and motors.

[18] While implementing energy efficiency improvements, the formulation of PU foam may also need to change. These costs are included in cost estimates given in table above.

of target performance to be achieved by the enterprise (as referred in subparagraph 20(c)). The rest will be paid through co-financing from the enterprise and non-MLF resources.

**Table 4. Additional costs for commercial refrigeration for a plant with a capacity of 100,000 refrigerated display cases per year**

| **Additional capital investment costs at an enterprise level** | | | |
|---|---|---|---|
| **Interventions** | | **Costs in US $** | |
| Product design and development | | 150,000 - 250,000 | |
| Training in energy-efficient product technology/design | | Nil - 50,000 | |
| **Total costs** | | **150,000 - 300,000** | |
| **Additional component costs for achieving different energy efficiency levels at the unit level i.e., a refrigerated display case with a display area of 2.5 $m^2$** | | | |
| **Energy consumption of the unit per year (kWh/year)** | Additional cost per unit if the unit moves to "low" energy-efficiency performance[19] i.e., 10,000 kWh/year | Additional cost per unit if the unit moves to "medium" energy-efficiency performance i.e., 6,500 kWh/year | Additional cost per unit if the unit moves to "high" energy-efficiency performance i.e., 5,800 kWh/year |
| Greater or equal to 13,500 kWh/year | 15.00 | 41.00 | 46.00 |
| Greater or equal to 10,000 and less than 13,500 kWh/year | NA | 26.00 | 28.00 |
| Greater or equal to 6,500 kWh/year and less than 10,000 kWh/year | NA | NA | 10.00 |

Assumptions: (1) If the manufacturing capacity is lower (e.g., 40,000), the additional capital investment costs would be lower. However, as manufacturing capacity and investment costs decrease, component costs may increase due to lower manufacturing capacity; (2) The enterprise sources the key components and **does not** manufacture these components within their own manufacturing plant/related manufacturing units; (3) Increasing the foam thickness to improve thermal insulation is included as an energy-efficiency measure due to the additional cost involved for the new formulations;[20] (4) This represents the additional component costs for conversion to different levels of energy consumption specified in the table; this assumes that the baseline equipment does not have any interventions implemented relating to energy efficiency and addresses only the conversion of refrigerant. (5) The target energy-efficiency levels shown in the table above are based on the United for Efficiency model regulations.

21. From the previous table, the following conclusions could be derived:

(a) The total cost, including investment and component costs, to enhance energy efficiency to the "low" level is US $1.80 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(b) The total cost, including investment and component costs, to enhance energy efficiency to the "medium" level is US $4.40 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

[19] Medium–variable speed compressor, heat exchangers, additional insulation foam (***partial enhancement***) for partial reduction in heat transfer into the equipment and improved fans and motors; high–variable speed compressor, heat exchangers, additional insulation foam (***full enhancement***) for greater reduction in heat transfer into the equipment and improved fans and motors.

[20] While implementing energy efficiency improvements, the formulation of PU foam may also need to change. These costs are included in cost estimates given in table above.

(c) The total cost, including investment and component costs, to enhance energy efficiency to the “high” level is US $4.90 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(d) With **an incentive, for example, of 25 to 50 per cent of the total cost of components**, the total incentive level paid to the enterprise would be within the range of US $1.45 million to US $2.60 million, at the lowest level of baseline energy efficiency and the highest level of target performance to be achieved by the enterprise (as referred in subparagraph 21(c)). The rest will be paid through co-financing from the enterprise and non-MLF resources.

### III.1.4 Residential air-conditioning units

22. Residential air-conditioners are used in households, shops, hotel rooms and other similar applications. The capacity of residential air-conditioners varies up to 3 TR,[21] depending on the user characteristics. The estimates of additional capital investment and additional component costs for a plant with a capacity of 300,000 units per year is given in table 5. As the capacity of the equipment can vary, the additional component costs are estimated for a 1.5 TR capacity air conditioner.

**Table 5. Additional costs for residential air conditioners for a plant manufacturing 300,000 units per year**

<table>
<tr><td colspan="4">Additional capital investment costs at an enterprise level</td></tr>
<tr><td colspan="2">Interventions</td><td colspan="2">Costs in US $</td></tr>
<tr><td colspan="2">Product design and development</td><td colspan="2">200,000 - 400,000</td></tr>
<tr><td colspan="2">Training in energy-efficient product technology/design</td><td colspan="2">Nil - 50,000</td></tr>
<tr><td colspan="2">Total costs</td><td colspan="2">200,000 – 450,000</td></tr>
<tr><td colspan="4">Additional component costs for achieving different energy-efficiency levels at a unit level i.e., a residential air conditioner with a capacity of 1.5 TR</td></tr>
<tr><td>Ratio of energy efficiency of equipment compared to the MEPS</td><td>Additional cost per unit if the unit moves to “low” energy-efficiency performance[22] i.e., ratio compared to MEPS of 1.33</td><td>Additional cost per unit if the unit moves to “medium” energy-efficiency performance i.e., ratio compared to MEPS of 1.67</td><td>Additional cost per unit if the unit moves to “high” energy-efficiency performance i.e., ratio compared to MEPS of 2.00</td></tr>
<tr><td>1.00 to 1.20</td><td>13.50</td><td>32.00</td><td>45.00</td></tr>
<tr><td>Greater than 1.20 to 1.67</td><td>NA</td><td>16.50</td><td>24.50</td></tr>
<tr><td>Greater than 1.67 to 2.00</td><td>NA</td><td>NA</td><td>8.00</td></tr>
</table>

Note: (1) The target levels given in the table represent the ratio of SEER to the MEPS for the equipment applicable for the relevant project beneficiary;[23] for air-conditioning equipment, these ratios are used to ensure the comparability of energy-efficiency ratios when different bases are used by the countries submitting the projects (e.g., EER, SEER). (2) The enterprise sources the key components and **does not** manufacture these components within their own manufacturing plant/related manufacturing units; (3) If the manufacturing volumes in the plant are lower, the costs will fall compared to the levels shown in the table above. (4) This represents the additional component costs for conversion to different levels of energy consumption specified in the table; this assumes that the baseline equipment does not have any interventions implemented relating to energy efficiency and addresses only the conversion of

[21] TR stands for ton of refrigeration. 1 TR is the heat-extraction capacity of RAC equipment. It was originally defined as the rate of heat transfer that results in the freezing or melting of 1 short ton (2,000 lb; 907 kg) of pure ice at 0 °C (32 °F) in 24 hours.
[22] Medium–variable speed compressor, heat exchangers, additional insulation foam (***partial enhancement***) for partial reduction in heat transfer into the equipment and improved fans and motors; high–variable speed compressor, heat exchangers, additional insulation foam (***full enhancement***) for greater reduction in heat transfer into the equipment and improved fans and motors.
[23] Seasonal energy efficiency ratio would vary depending upon the specific geographic location (e.g., country); this will be used as the basis for assessment of energy efficiency performance.

refrigerant. (5) In case of heat pump, energy efficiency improvement may need further product redesign including resizing of some of the components, including heat exchangers. As such, heat pump energy efficiency conversion may require higher costs compared with air conditioning.

23. From the previous table, the following conclusions could be derived:

(a) The total cost, including investment and component costs, to enhance energy efficiency to the "low" level is US $4.50 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(b) The total cost, including investment and component costs, to enhance energy efficiency to the "medium" level is US $10.05 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(c) The total cost, including investment and component costs, to enhance energy efficiency to the "high" level is US $13.95 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(d) With **an incentive, for example, of 25 to 50 per cent of the total component cost**, the total incentive level paid to the enterprise would be within the range of US $3.83 million to US $7.20 million, at the lowest level of baseline energy efficiency i.e., highest energy consumption per year in the table above (as referred in subparagraph 23(c)). The rest will be paid through co-financing from the enterprise and non-MLF resources.

24. The incentive mechanism should consider the market factors leading to adoption of energy efficient non-HFC refrigerant based products and also the national strategy in the KIPs for air-conditioning sector. Opportunities for incentivising transition to non-HFC technologies keeping in view the above-mentioned factors can be considered.

### III.1.5 Commercial air-conditioning equipment

25. Commercial air-conditioning equipment typically include package units, variable refrigerant flow (VRF) systems and chillers; this equipment has capacity ranging from 5 TR to 100 TR or more. The equipment are designed and, in many instances, customized for specific customer needs. While some of the equipment would be factory charged and installed at site, in other cases, this equipment would be installed and charged local. Currently, packaged air-conditioning units have the largest global market share. These units are typically factory charged.

26. For the purpose of this report, additional costs are assessed for the equipment with the highest sales, namely packaged air-conditioning systems with cooling capacity ranging from 5 to 100 TR. The estimates of additional capital and component costs for a plant with a capacity of 50,000 units per annum are given below. As the capacity of the equipment can vary, the additional component costs are estimated for a capacity of 10 TR in table 6 below.

**Table 6. Additional costs for commercial air conditioners for a plant with a capacity of 50,000 units per annum**

| **Additional capital investment costs at an enterprise level** | | | |
|---|---|---|---|
| **Interventions** | | **Costs in US $** | |
| Product design and development | | 400,000 - 700,000 | |
| Training in energy-efficient product technology/design | | Nil - 50,000 | |
| **Total costs** | | **450,000 – 750,000** | |
| **Additional component costs for achieving different energy-efficiency levels at a unit level i.e., a commercial air conditioner with a capacity of 10 TR** | | | |
| **Ratio of energy efficiency of equipment compared to the MEPS** | Additional cost per unit if the unit moves to "low" energy-efficiency performance[24] i.e., ratio compared to MEPS of 1.20 | Additional cost per unit if the unit moves to "medium" energy-efficiency performance i.e., ratio compared to MEPS of 1.40 | Additional cost per unit if the unit moves to "high" energy-efficiency performance i.e., ratio compared to MEPS of 1.67 |
| 1.00 to 1.20 | 56.00 | 143.00 | 176.00 |
| Greater than 1.20 to 1.40 | NA | 94.00 | 120.00 |
| Greater than 1.40 to 1.67 | NA | NA | 51.00 |

Note: (1) The target levels given in the table is the ratio of the seasonal energy efficiency ratio (SEER) to the MEPS (1.00) for the equipment; for air-conditioning equipment, these ratios are used to ensure comparability of energy efficiency ratios when different bases are used (e.g., Energy Efficiency Ratio (EER), SEER). (2) The enterprise sources the key components and **does not** manufacture these components within their own manufacturing plant/related manufacturing units; (3) If the manufacturing volumes in the plant are lower, the costs will fall compared to the levels shown in the table above; (4) This represents the additional component costs for conversion to different levels of energy consumption specified in the table; this assumes that the baseline equipment does not have any interventions implemented relating to energy efficiency and addresses only the conversion of refrigerant. (5) In case of heat pump, energy efficiency improvement may need further product redesign including resizing of some of the components, including heat exchangers. As such, heat pump energy efficiency conversion may require higher costs compared with air conditioning.

27. From the previous table, the following conclusions could be derived:

(a) The total cost, including investment and component costs, to enhance energy efficiency to the "low" level is US $3.55 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(b) The total cost, including investment and component costs, to enhance energy efficiency to the "medium" level is US $7.90 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(c) The total cost, including investment and component costs, to enhance energy efficiency to the "high" level is US $9.55 million for an enterprise with equipment at the lowest baseline energy efficiency i.e., highest energy consumption per year in the table above.

(d) With **an incentive, for example, of 25 to 50 per cent of the total component cost**, the total incentive level paid to the enterprise would be in the range of US $3.39 million to US $5.15 million, at the lowest level of baseline energy efficiency i.e., highest energy consumption per year in the table above (as referred in subparagraph 27 (c)). The rest will be paid through co-financing from the enterprise and non-MLF resources.

[24] Medium–variable speed compressor, heat exchangers, additional insulation foam (***partial enhancement***) for partial reduction in heat transfer into the equipment and improved fans and motors; high–variable speed compressor, heat exchangers, additional insulation foam (***full enhancement***) for greater reduction in heat transfer into the equipment and improved fans and motors.

28. As mentioned in paragraph 24, the incentive mechanism should consider the market factors leading to adoption of energy efficient non-HFC refrigerant-based products and also the national strategy in the KIPs for air-conditioning sector. Opportunities for incentivising transition to non-HFC technologies keeping in view the above-mentioned factors could be considered.

### III.1.6 Project completion timeframe

29. The projects shall be completed within 36 months from the date of approval; if the projects cannot be completed within 36 months from the date of approval, incentives available to the enterprise would be adjusted to the energy-efficiency levels achieved at the end of 36 months.

### III.1.7 Payment process for the incentive mechanism

30. The weighted average energy-efficiency performance target achieved upon completion of the project for the equipment manufactured and sold will be used to assess the energy-efficiency improvement levels. Based on this assessment, the levels of incentives to be paid to the beneficiaries would be determined for the different categories of equipment.

31. As explained above, the total funding available to the beneficiary would have two components; one would relate to additional investment costs and the other would be the incentive component. During the project cycle, additional agreed investment costs would be available up-front to the beneficiary enterprise through the implementing agency.[25] The variable incentive component (i.e., incentive value in US $ per unit) would be available based on performance i.e., at the end of project implementation and after confirmation that the enterprise has achieved the energy-efficiency performance target it committed to in the project.

### III.1.8 Incentive for the adoption of low-GWP technology

32. In the case of domestic and self-contained commercial refrigeration equipment, incentives shall be available for enterprises adopting energy-efficient technologies that do not use controlled substances.

33. In the case of residential and commercial air-conditioning equipment, a discount in the incentive level could be considered (e.g., provided at [XX] per cent of the agreed levels) if the enterprise has decided to continue using controlled substances through KIP conversion project. Enterprises that adopted lower-/low-GWP refrigerant-based technologies when converting from HCFCs to alternatives during the HCFC phase-out management plan (HPMP) could be considered eligible to access support relating to energy efficiency under this operational framework, provided they convert to substances that are not controlled under the Montreal Protocol and satisfy other eligibility criteria relating to HFC phase-down (e.g., Article 5 ownership, establishment prior to cut-off date).

### III.1.9 Changes in baseline energy-efficiency performance levels and costs

34. In its May 2023 report, the TEAP energy efficiency working group discussed how the energy-efficiency performance levels improve over time for different equipment based on technology development and the regulatory environment in different countries. The report also highlights the reduction in the cost of components that could make it attractive for manufacturers to adopt energy-efficient technologies.

[25] As explained earlier, the funding for additional investment component can vary depending upon the project specific requirements; during the project review process, these costs need to be assessed based on project specific requirements.

35. In light of this, the following approach could be considered:

(a) Upon approval of incentive levels by the Executive Committee, adjustments in the incentive levels will be considered for projects coming later compared to those coming earlier as the component prices are decreasing over time due to factors explained in paragraph 10. For example, projects considered in the years 2024, 2025 and 2026 would get an incentive of 100 per cent, 60 per cent and 40 per cent of the incentives in case of domestic and commercial refrigeration equipment and residential air-conditioning equipment and 100 per cent, 80 per cent and 70 per cent of the incentive in case of commercial air-conditioning system.

(b) The incentive mechanism needs to be reviewed at the last Executive Committee meeting of the year 2026 to make necessary adjustments to the incentive levels based on *inter alia* lessons learned from implementing the incentive scheme, technical and market factors, and changes in the cost of components.

## III.2 Manufacturing of components

36. Component manufacturing contributes to improvements in energy efficiency. Component manufacturing can be "in-sourced" or a "make option" (i.e., components can be procured by the equipment manufacturers at their own facilities for technical and commercial reasons) or "out-sourced" or a "buy option" (i.e., components can be procured from outside suppliers).[26]

37. For the purpose of this report, the component-manufacturing-related costs for compressors and heat-exchangers are considered, noting that these are the typical components that would result in the energy-efficiency improvement of equipment.

### III.2.1 Manufacturing of compressors (stand-alone)

38. Compressor manufacturers for RAC equipment continuously improve product design to achieve better energy-efficiency levels. The capacity of the manufacturing facilities and the technical capabilities of the different companies can vary. The enterprises that manufacture these components are typically large in size and have technical personnel and infrastructure for designing and developing new products using low-GWP technologies.

39. For the purpose of this report, a compressor manufacturer with a manufacturing capacity of 2 million compressors per year is assumed. For energy-efficiency improvements, the estimated additional capital investment costs for different operations in the manufacturing are given in table 7 below.

**Table 7. Additional investment costs for a plant that manufactures 2 million compressors per year (US $)**

| Particulars | Activities | Costs for a compressor with capacity of less than 1 TR | Costs for a compressor with capacity between 1 TR and 2 TR |
|---|---|---|---|
| Product design and development | Costs of technical personnel for design and development of energy efficient compressor | 600,000 | 600,000 |
| Manufacturing-facility modification | Changes in tooling, metrology set-up, surface treatment and procurement of calorimeter | 750,000 | 950,000* |

[26] The decision of manufacturers of equipment to "make" or "buy" would depend *inter alia* on manufacturing volumes, technical product development and manufacturing capabilities, business policy and strategy on sourcing components, and the availability and ease of sourcing the different components.

| Particulars | Activities | Costs for a compressor with capacity of less than 1 TR | Costs for a compressor with capacity between 1 TR and 2 TR |
|---|---|---|---|
| Prototype manufacturing and testing | Manufacturing of prototype for a small manufacturing run and compressor calorimetry test laboratory setup for high efficiency compressors | 175,000 | 300,000* |
| **Total costs for a plant that manufactures 2 million compressors** | | **1,525,000** | **1,850,000** |

*The costs given in the table above relate to modifications such as changes in tooling and other operations in facilities that manufacture compressors for higher-capacity air-conditioners; the additional costs for prototype manufacturing and testing are on account of higher costs for larger-capacity compressors.

Note: Design of compressors would need very high technical expertise in modelling, computational fluid dynamics (CFD) design capabilities; the estimates of the costs include personnel costs for undertaking detailed modelling, design and testing.

40. In light of the variations that exist in the compressor manufacturers' requirements, the additional costs for compressor manufacturing for energy efficiency needs to be assessed on a case-by-case basis. Also, for larger-capacity compressors for large commercial refrigeration equipment or large commercial air-conditioning equipment, the costs could be different for different manufacturers.

41. The manufacturing facilities for compressors would generally supply to different equipment manufacturers; while some of the equipment manufacturing facilities would have internal sourcing of the compressors, compressor procurement is generally outsourced for a range of technical and commercial reasons. In the past and in the context of ODS phase-out/HFC phase-down projects, when compressor manufacturing was internally sourced during the conversion project and the cost of compressor manufacturing conversion was included in the overall project costs, the incremental costs relating to compressor manufacturing were subtracted from the total incremental cost calculations.

42. Based on normal industry practices, it is known that compressor manufacturers develop new products with better performance characteristics, including better energy efficiency, well in advance of the time when they place those products on the market; the product's market launch is based on each compressor manufacturer's business strategy and commercial considerations (e.g., volume of energy-efficient equipment that are expected to be sold). Thus, while the technology for manufacturing components is available, the availability of those components at the initial stages of introduction could be limited and consequently, they could be higher in price.

### III.2.2 Manufacturing of heat exchangers (stand-alone)

43. Heat exchangers include both fin and tube heat exchangers (FTHXs) and microchannel heat exchangers (MCHXs) used in manufacturing heat exchangers (evaporators and condensers) for the different categories of equipment described above. While manufacturing facilities using FTHXs could have component manufacturing facilities in-house, for manufacturing MCHXs, the manufacturing volumes need to be very large (typically of the order of 1,000,000 units per annum) to have an in-house MCHX manufacturing facility.

44. For the purpose of this report, a FTHX and MCHX manufacturing facility with an annual production capacity of 500,000 and 1,000,000 units per annum, respectively, is assumed. For energy-efficiency improvements, the estimated capital investment for different manufacturing operations is given in table 8 below.

**Table 8. Additional costs for heat exchanger manufacturing plants with a capacity of either 500,000 FTHX units or 1 million MCHX units per annum (US$)**

| Manufacturing facility capacity | Description of activities | FTHX | MCHX |
|---|---|---|---|
| | | **500,000 per annum** | **1 million per annum** |
| Product design and development | Costs of technical personnel for design and development of energy-efficient compressor | 160,000 | 160,000 |
| Manufacturing-facility modification* | Modification in manufacturing line, design software, fin die, fin press | 240,000 | 540,000 |
| Prototype production and testing | Manufacturing of prototype for a small manufacturing run | 50,000 | 50,000 |
| **Total** | | **450,000** | **750,000** |

*In the case of FTHX, tube design changes for energy efficiency require additional investment in dies. In the case of MCHX, only changes relating to press for fins manufacturing and corresponding investments is required.

45. If the manufacturing capacity of the component manufacturer is different from the capacity set out in table 8, the cost assessment for the facility needs to be undertaken on a case-by-case basis. In the case of MCHX, currently, the manufacturing of heat exchangers is outsourced by manufacturers of equipment. In the case of FTHX, manufacturers would have in-house manufacturing facilities. As explained earlier, if the manufacturing of components is covered under MLF funding, the incremental operating costs for conversion projects are adjusted for the incremental costs relating to those components.

## Part IV: NON-INVESTMENT ACTIVITIES

46. The ensuing paragraphs provide an overview of the costs that may be associated with activities that are not investment related, and that promote capacity building to implement energy-efficiency-related interventions while phasing down HFCs. As explained above, the costs for non-investment activities would follow an activity-output-based approach.

### IV.1 Technical assistance to SMEs

47. In the context of KIPs, SMEs[27] are largely engaged in manufacturing commercial refrigeration equipment and residential and commercial air-conditioning equipment, and to a limited extent, in residential air-conditioning equipment.[28]

48. SMEs have limited technical and financial capacity to adopt new technologies; as a result, in the past, there has been careful consideration of their needs, as well as additional funding support for the adoption new technologies, especially low-GWP technologies.[29] If technical assistance for adopting new energy-efficient technologies is not provided to SMEs, they could face business continuity challenges. As such, in relation to the HFC phase-down activities, many SMEs face challenges due to competition from large manufacturing enterprises in the country and imports from large manufacturers outside the country. Furthermore, SMEs would face additional challenges while implementing measures relating to energy efficiency for the equipment manufactured, while phasing down HFCs; as a result, they would resist changes in energy-efficiency improvement, and this could result in delays in implementing policies and regulations relating to energy efficiency in the context of HFC phase-down. Therefore, support for adopting energy efficient technologies at lower component costs would be meaningful for assisting SMEs for sustainable energy efficiency improvements. Past experience in the implementation of project activities

[27] Currently, in the context of discussions relating to cost guidelines for HFC phase-down, issues relating to the definition of SMEs are under discussion.

[28] Assembly and on-site installation would involve a number of SMEs which is discussed in the section relating to assembly and installation.

[29] Decision 74/50(c)(iii)

involving SMEs shows that transaction costs for providing support to SMEs are high due to their small size and geographic distribution.

49. The number of enterprises is difficult to estimate at this stage. The funding support for technical assistance would largely relate to technical workshops with enterprises, information exchange programmes and redesign/product development and manufacturing-related consultations with the enterprises. The funding modality can provide a **fixed amount** for technical information outreach and awareness workshops and another **fixed amount** for training and technical support for the design and adoption of energy-efficient technologies.

### IV.2 Support for local installation and assembly

50. Background information relating to the local installation and assembly subsector, including the types of equipment and refrigerants, and the challenges involved in transitioning to low-GWP alternatives, was presented to the Executive Committee (documents UNEP/OzL.Pro/ExCom/92/49 and UNEP/OzL.Pro/ExCom/93/99). Currently, projects for these applications can be considered on a case-by-case basis under KIPs (decision 92/39(d)). The activities relating to local installation and assembly under KIPs are under discussion in the Committee. These activities could also cover energy-efficiency aspects in the design, installation and maintenance of the equipment that is assembled and installed onsite.

51. The number of enterprises is difficult to estimate at this stage. Furthermore, the support for technical assistance would largely relate to technical workshops, information exchange programmes and consultations with the enterprises. The funding modality can provide a **fixed amount** for technical information outreach and awareness activities (e.g., awareness workshops that could include component suppliers, institutions providing finance for the installations, study tours for understanding technical aspects relating to the installation and maintenance of new technologies) and another **fixed amount** for technical training and other measures to support the adoption of energy efficient technologies**.**

52. This excludes support for other project activities, if any, that may be approved under the KIP for local installation and assembly. Furthermore, the users and local installers and assemblers could benefit from financial products for adopting energy-efficient technologies while phasing down HFCs. Such financial products typically involve non-MLF funding sources (e.g., soft loans, performance risk guarantee products). This could be considered while designing and conducting awareness programmes and other events so that relevant stakeholders who could finance local installers and assemblers could be engaged in supporting local installers and assemblers.

### IV.3 Servicing

53. Under KIP implementation, countries are expected to include capacity-building activities for the servicing sector. These activities primarily relate to good servicing practices that minimize emissions of HFCs, and to equipment installation, maintenance and servicing that improves equipment operation. Such activities include *inter alia* training of trainers and technicians in good practices including upgrading the training materials that cover different applications, supporting national certification of technicians, providing equipment support to technical institutions for training on new technologies, supporting the implementation of certification systems, putting in place end-user incentives/demonstration projects for alternative technologies, and supporting RAC service agencies, RAC associations and the equipment distribution chain to promote the adoption of alternative technologies. These activities would contribute to the good installation, maintenance and servicing of equipment and result in the energy-efficient performance of equipment.

54. The Executive Committee has taken decision 92/37 on the level of funding for HFC phase-down in the refrigeration servicing sector. The eligible activities to be implemented in the sector during HFC phase-down would also cover to some degree aspects relating to energy efficient operations of the

equipment and this is also the case for ongoing HPMP activities relating to servicing sector.[30] Thus, the activities that would be undertaken relating to energy efficiency in service sector need to be implemented taking a holistic view of these different activities and maximising synergies, wherever feasible.

55. Taking into consideration the above, the following activities could be considered for the servicing sector to maintain the energy efficiency of equipment.

(a) Upgrading training content to include energy-efficiency-related aspects (e.g., new electronic controls and new components that would result in the energy-efficient operation of equipment);

(b) Providing additional support to training institutions and facilities, such as the training of trainers in energy efficiency, and providing equipment relating to energy efficiency for the training of servicing technicians in energy efficiency; synergies with activities implemented under the KIP need to be maximized for the development of cost-effective training facilities and the delivery of training activities;

(c) Providing support for institutional coordination with energy-efficiency authorities to ensure that Kigali Amendment provisions are appropriately incorporated into energy-efficiency regulations;

(d) Conducting awareness and information outreach activities on energy-efficient equipment using alternative technologies, and providing information on energy-efficiency standards, labelling and other measures for RACHP equipment to relevant stakeholders.

56. The support requirements for the servicing sector would vary for different countries depending upon the national-level assessments of servicing sector needs. For example, if there is need for strengthening the certification-system related to energy efficiency or the establishment of a product registry of energy-efficient low-GWP refrigerant-based RACHP equipment, countries need to be in a position to implement those activities with the available funding support. Flexibility in allocating funds for different activities in service sector would help the countries in implementation of different energy efficiency activities.

57. The funding requirements for maintaining energy efficiency could be considered at a **percentage** of the levels agreed under decision 92/37 for countries with a consumption of less than 360 mt of HFCs in servicing in the baseline years and **at pre-defined levels** for countries with consumption above 360 mt, on the understanding that the training activities for the servicing sector shall only be provided under the KIP and any additional activities relating to energy efficiency in the servicing sector would be those mentioned in paragraph 55 (a) to (d) above. Future activities relating to servicing sector can be designed based on the impact of the activities reviewed by the last meeting of the year 2026.

## IV.4 Testing centres

58. Testing centres would require investments in equipment infrastructure. Table 9 below provides an estimate of the investment needed for equipment required by testing centres for different types of equipment.

[30] Support is also available under decision 89/6 for energy efficiency related activities for LVC countries under HPMPs.

**Table 9. Cost of establishing testing centres for different categories of equipment (US$)**

| Priority Sector | Capital cost | Accreditation | Total |
|---|---|---|---|
| Domestic refrigeration and self-contained commercial refrigeration | 600,000 | 10,000 | 610,000 |
| Residential air-conditioning | 600,000 | 10,000 | 610,000 |

*Estimates based on SEAD Initiative Study, TEAP supplementary report for replenishment of the Multilateral Fund for the triennium 2024–2026.

59. If multiple categories of equipment are included, the total funding requirement would be higher. The Executive Committee could also consider a limit to the number of such centres that could be funded in each region. A viable business model needs to be designed for the establishment and continuous operation of a testing centre. This is critical to ensure the continuity of operations and the testing centre's ability to provide support for testing and certification. The key elements of a business model include, *inter alia*:

(a) The role of the centre and its governance structure, including the regulatory environment relating to energy efficiency;

(b) The testing and certification infrastructure and mechanisms for periodic upgrades of the centre;

(c) The centre's organizational structure with details on staff roles, responsibilities, and skills; and

(d) The sources and uses of funds, as well as risk-management processes including opportunities for co-funding for managing the centre's operations (e.g., revenue streams from different sources including earnings related to national/regional MEPS testing and certification).

60. If the centre is established to provide support to the region, a process for the operations of this centre to provide support to the countries in the region needs to be negotiated and established. In this case, finalizing the relevant process and regulatory arrangements may require additional time.

### IV.5 Regional centres of excellence for technical and policy assistance

61. Regional centres of excellence would require investment to develop in-house capacity building related to energy-efficient equipment design and development for SMEs, training on energy-efficiency best practices for installation and servicing, training for service technicians to maintain equipment operating at maximum efficiency throughout the equipment's lifetime, the enforcement of energy-efficiency policies and regulations, and monitoring.

62. These centres would complement the existing centres established to provide training under the KIPs. Being located in the region, these centres could provide cost-effective capacity-building support to service technicians, particularly the trainers, and assist in updating/upgrading training modules relating to the energy-efficient operation of different RAC equipment.

63. The additional cost of providing support to an existing centre is estimated assuming that a centre of excellence/training centre for the KIP would also manage the centre of excellence for support on energy efficiency and is presented in table 10.

**Table 10. Additional activities for centres of excellence**

| Sector | Particulars |
|---|---|
| SME Manufacturing | • Equipment for energy-efficiency systems design and modelling tools<br>• Development of training materials for systems design and modelling<br>• Training of trainers on product development |
| Training for installation and servicing – for local assembly and installation | • Training material development<br>• Training of trainers<br>• Fully equipped training centre with simulators |
| Training for service and maintenance technicians to keep equipment operating at peak performance | • Training material development for trainers and modules for service technicians<br>• Training of trainers |
| Training on policy development and enforcement relating to energy efficiency | • Training material development<br>• Training of trainers |

Note: It is assumed that the trainees participating in the training programmes would pay for travel, boarding/lodging and training material support at the training centre; the value of this would vary depending upon the number of trainees trained in different programmes.

64. A viable business model demonstrating that the centre would fully cover the operating costs, needs to be designed for the continuous operation of the regional centre of excellence. This is critical to ensure the continuity of operations and the centre of excellence's ability to provide support for the different target audiences in the region. The business model must include, *inter alia*:

(a) The role of the centre and its governance structure;

(b) The training infrastructure and mechanisms for periodic upgrades of the centre;

(c) The centre's organizational structure with details of staff roles, responsibilities and skills; and

(d) The sources and uses of funds, as well as risk-management processes including opportunities for co-funding for managing the centre's operations (e.g., they could provide technical support in sourcing components for SMEs, installers, and local assemblers).

65. The regional centres should develop an operational business model with a co-financing plan for ongoing sustained operations beyond the support provided by the project. With the increase in demand for RACHP equipment, the need for training support is expected to increase and thus, based on activity levels, the operations of these centres could expand to offer services based on the needs of the countries in the region.

## IV.6 Feasibility study on district cooling

66. District cooling projects can provide opportunities for the adoption of energy-efficient low-GWP refrigerant technologies. As explained in paragraph 28(s) of UNEP/OzL.Pro/ExCom/91/64, these projects would have large funding requirements and may involve complex business models, depending on project size. The operationalization of these projects could also involve a large number of stakeholders (e.g., local Government municipal bodies, local and international funding institutions, operations and maintenance contractors).

67. Funding for project development could be considered at fixed amount for projects demonstrating strong national commitment through policies and regulatory support for district cooling. Strong national commitment would result in active participation of service providers in investing and operating these

facilities. Only with strong Government commitment and consequent active interest by service providers, district cooling projects can be successfully operationalised.

### IV.7 Retrofitting of large refrigeration and air-conditioning systems with energy-efficient alternatives

68. Retrofitting or large RAC systems with energy-efficient alternatives would result in reducing dependence of such equipment with technologies using high-GWP refrigerants and that are not energy efficient. Like district cooling projects, these projects could involve large funding requirements. They would also require careful planning and execution and would largely be driven by national regulatory requirements and/or operational cost savings generated by the new energy-efficient technologies.

69. The total funding requirement for these activities would depend on the way these activities are designed and proposed to be undertaken, a strong national level of commitment to support such projects, and the impact these activities are expected to have on the adoption of energy-efficient technologies while phasing down HFCs. Funding for project development could be considered on a case-by-case basis based on number of enterprises that would participate in the retrofit projects. The evaluation would be based on the project funding requested in US $/kWh saved as a result of the project, and on the retrofitting activities' impact on the adoption of energy-efficient alternative technologies at the national and regional/global level (e.g., scaled-up adoption, replicability). The implementation of the projects is primarily based on the cost-benefit analysis undertaken by the end users.

### IV.8 Project preparation funding for projects under the operational framework for energy efficiency

70. Project preparation funding for energy efficiency under the operational framework would be required for the preparation of a detailed plan for maintaining and/or enhancing energy efficiency in the context of HFC phase-down[31]. Keeping in view the need to ensure quality projects on energy efficiency under the operational framework, project preparatory funding at the levels given in table 11 below could be considered. The levels proposed below are based on the recent decision taken by the Executive Committee on the preparation of national inventories of banks of used or unwanted controlled substances and a plan for the collection, transport, and disposal of such substances (decision 91/66). 50 per cent of the levels approved in that decision is proposed for the additional efforts needed for developing a project plan for the energy efficiency components, keeping in view that the KIP preparation activities would result in or have resulted in information on HFC consuming industry in the country.

**Table 11. Preparatory funding for projects under the operational framework for energy efficiency**

| HCFC baseline (ODP tonnes) | Project preparation funding as per decision 91/66 (US $) | Project preparation funding proposed (US $) |
|---|---|---|
| Below 1 | 70,000 | 35,000 |
| Between 1 and 6 | 80,000 | 40,000 |
| Above 6 and up to 100 | 90,000 | 45,000 |
| Above 100 | 100,000 | 50,000 |

71. In the case of countries where KIP preparation is ongoing, the existing investment project funding could be used to prepare energy-efficiency-related additional components under the operational framework. In the case of countries where KIP preparation has been completed and where investment projects for energy efficiency are needed, a percentage of funds agreed (e.g., 25 percent of the funds agreed) in paragraph (f) of decision 87/50 could be considered for the preparation of individual investment projects.

[31] Requests for project preparation have been submitted in relation to pilot projects on energy efficiency under decision 91/65.

## Part V: CONDITIONS FOR FUNDING

### V.1 Conditions associated with the energy-efficiency project funding modality

72. The conditions associated with the energy-efficiency project funding modality are given below:

(a) The Government and the beneficiary, for manufacturing conversion projects, would provide a commitment that the enterprise would manufacture products at the agreed energy-efficiency levels as defined under the project or above such levels; the beneficiary would provide a report on an annual basis on achieving this for a period of two years from the date of operational completion of the project to demonstrate improvements in energy efficiency;

(b) For implementing manufacturing conversion projects relating to energy efficiency, the Government shall commit to implementing and enforcing policies and regulations relating to energy efficiency standards above the levels for the applications covered under the project, and to continuously strengthening those standards in the future to enable the sustainability of the conversion projects; the standards should be applicable for both local manufacturing and imported equipment covered under the project;

(c) If activities for phase down of HFCs include SMEs in applications that receive funding during a stage of a KIP and they also receive funding for energy efficiency related activities, then support must be provided to these enterprises to ensure the sustainability of the energy-efficiency measures. Issues relating to SMEs in the relevant applications relating to energy efficiency need to be considered on a case-by-case basis;

(d) If target energy efficiency levels are not achieved, the incentive levels would be adjusted to the weighted average energy efficiency achieved in accordance with the tables 2 to 6 at the end of 36 months from the date of project approval;

(e) The monitoring bodies (e.g., project review committee, national ozone committee or equivalent) for the implementation of the KIP and other projects relating to the MLF shall include representation from energy-efficiency authorities in the country and, to the extent feasible, representatives from the implementing agencies. This will facilitate better coordination with energy-efficiency authorities, catalyse the implementation of the provisions of the Kigali Amendment in relevant energy-efficiency policies and regulations and obtain inputs based on the experience of the agencies; and

(f) Implementing agencies could also coordinate with the units handling energy efficiency within their respective organisations; this will help the agencies strengthen their capacity in providing support to the countries.

### V.2 Updated information on the role of other institutions addressing energy efficiency, where appropriate

73. Engaging local financial institutions in promoting energy efficiency in RACHP applications is an important endeavour to facilitate sustainable promotion and adoption of energy efficiency in these applications. It is known that organizations like the Green Climate Fund (GCF), the Global Environment Facility (GEF) and other regional development banks undertake activities to engage local financial institutions for consumer finance, both for institutional and individual consumers. The policies of the different financial institutions to direct the financing of energy-efficient technologies in different markets could help boost market demand for energy-efficient products and, when appropriately combined with supply-side measures, can yield faster adoption of energy-efficient technologies in different markets.

74. To begin with, the national ozone unit (NOU) could work with the local financial institutions on information exchange and awareness activities covering: energy-efficiency-related technical developments in different RACHP applications relevant to funding the local industry; policies and regulations planned by the Government and/or in the region on the adoption of energy-efficient technologies in RACHP applications and how this can impact the growth of energy-efficient technologies and the involvement of international funding institutions in supporting these initiatives, including low-cost options through blended finance or innovative financial products. This would help strengthen national financial institutions' understanding of projects and policies relating to energy efficiency while phasing down HFCs.

75. In addition to this, it is necessary to develop processes for establishing national mechanisms to ensure that the funding provided for energy-efficiency-related activities is not duplicated (i.e., such activities are not being undertaken by national or international financial institutions in parallel) and to work in a complementary manner with the available funding through different sources. This needs to be undertaken through a consultative process with different institutions to address specific actions and institutional mechanisms.

76. There is also the need to continuously follow developments relating to funding opportunities for energy efficiency in RACHP applications through non-MLF sources at the national level (e.g., there could be a project approved with support from a specific donor organisation at some point in time during implementation of HFC phase-down activities). This would involve having the NOU engage with other national institutions that deal with financing linked to energy-efficiency policies and projects relating to RACHP applications, identifying new non-MLF sources of funding that could support energy-efficiency-related activities in RACHP applications, and exploring any opportunities for collaboration with non-MLF institutions. For this, the NOU, to the extent feasible and keeping in view the operational needs to work with other funding institutions, could identify staff with the defined role to undertake these activities.

## Part VI: MONITORING AND REPORTING OF PROGRESS AND OUTCOMES

### VI.1 Proposed methodology for providing funding, monitoring and reporting on the progress of projects

77. The proposed methodology for providing funding for the different activities would vary depending on whether one is following an incentive-based approach or an activity-output-based approach. As explained earlier, the incentive-based approach is proposed for the manufacturing enterprises. For the other categories of projects, an activity-output-based approach could be followed, with payment tied to the achievement of different milestones.

78. The overall monitoring and evaluation process under the operational framework would include the data gathered through the monitoring reports applicable to the projects, aggregated at the national/regional level and at the MLF level. The reporting processes should therefore be flexible enough to capture outcome parameters in such a way as to provide a holistic understanding of the impact of different activities. Thus, a small number of core indicators should be common across the projects and there could be other indicators which can be captured based on project-specific characteristics.

### VI.2 Project-level monitoring and evaluation of outputs/outcomes

79. This subsection presents information on project monitoring reports and the payment process for different interventions in table 12 below.

**Table 12. Project-level monitoring reports for evaluation of outputs/outcomes and payment process**

| Interventions in sectors | Reporting and payment |
|---|---|
| Investment/Manufacturing of equipment (domestic refrigeration equipment, self-contained commercial refrigeration equipment, residential AC equipment, commercial AC equipment)<br><br>(Incentive-based) | *Reporting*<br>• Baseline information on energy performance[32] assessed during submission based on manufacturing and sale of relevant equipment.<br>• Upon project completion, the target performance based on manufacturing and sale of relevant equipment would be assessed.<br>*Payment*<br>• Investment component for the project would be made available to beneficiary up-front for project implementation.<br>• Based on performance, the incentive component would be made to beneficiary available according to Executive Committee guidelines. |
| Investment/Manufacturing of components: compressors and heat-exchangers (FTHX and MCHX)<br><br>(Activity-output-based) | *Reporting*<br>• Baseline information on energy performance[24] assessed during submission based on manufacturing and sale of relevant components.<br>• Upon project completion, the target performance based on manufacturing and sale of the components would be assessed.<br>*Payment*<br>• Portion of total funding paid up-front to beneficiary upon signature of project-related contracts and overall plan of action.<br>• Remaining paid to beneficiary on achievement of project activity output indicators. |
| Non-investment/Technical assistance for SMEs<br><br>(Activity-output-based) | *Reporting*<br>• Project outputs/outcomes for different activities would be monitored by the implementing agency and periodic reports would be provided by the agency; this would cover agreed activities included in the project.<br>• Enterprise-level verification would be undertaken through a sampling method and a self-declaration process regarding the achievement of targets; regulations would need to be implemented at the national level to ensure that energy performance targets are achieved.<br>*Payment*<br>• Percentage (e.g., 70-90 per cent) of total funding paid up-front to the country upon project approval.<br>• Remaining to be paid on achievement of project activity output indicators. |
| Non-investment/Technical assistance for local assembly and installation<br><br>(Activity-output-based) | *Reporting*<br>• Project outputs/outcomes for different activities would be monitored by the implementing agency and periodic reports would be provided by the agency; this would cover agreed activities included in the project.<br>*Payment*<br>• Percentage (e.g., 70-90 per cent) of total funding paid up-front to the country upon project approval.<br>• Remaining to be paid on achievement of project activity output indicators. |

[32] The energy performance assessment would be undertaken either by an accredited laboratory at the enterprise or an external laboratory.

| Interventions in sectors | Reporting and payment |
|---|---|
| Non-investment/<br>Servicing sector support<br><br>(Activity-output-based) | *Reporting*<br>• Project outputs/outcomes for different activities would be monitored by the implementing agency; this would cover agreed activities included in the project.<br>*Payment*<br>• Percentage (e.g., 70-90 per cent) of total funding paid up-front to the country upon project approval.<br>• Remaining to be paid on achievement of project activity output indicators. |
| Non-investment/<br>Support for testing centres and centres of excellence<br><br>(Activity-output-based) | *Reporting*<br>• Project performance of different activities relating to the establishment and operation of the testing centres and centres of excellence would be monitored by the implementing agency; this will also include the how the testing centre or centre of excellence is performing against the submitted business plans.<br>*Payment*<br>• Percentage (e.g., 70-90 per cent) of total funding paid up-front to the country upon project approval.<br>• Remaining to be paid on achievement of project activity output indicators. |
| Non-investment/<br>Support for feasibility studies for district cooling and for retrofitting existing equipment<br><br>(Activity-output-based) | *Reporting*<br>• Project report of the feasibility study undertaken including information on awareness and outreach on the feasibility study results<br>*Payment*<br>• 100 per cent of total funding paid up-front to the agency, provided there is a strong commitment from the Government and service providers are actively engaged in development/participation of the projects |
| Non-investment/<br>Energy-efficiency project preparation funding | *Reporting*<br>• Implementation plan for energy-efficiency activities under the operational framework for the consideration of the Executive Committee in line with the guidelines approved by the Executive Committee.<br>*Payment*<br>• 100 per cent of total funding paid up-front to the agency, provided there is a strong commitment from the Government and end-users in implementing these projects |

* In the case of SMEs, the project monitoring for equipment manufacturing activities would be defined under the project.

### VI.3 Monitoring and reporting on projects

80. The overall outcome of the project(s) at the national level needs to be measured based on the indicators given below; reporting on these indicators would follow the current project progress reporting processes:

(a) Total number of projects, investment and non-investment, approved in the country;

(b) Total funds approved and disbursed for the projects in the country for national projects, and in the region/world for regional or global projects;

(c) Implementation and progress of MEPS that include Kigali Amendment provisions[33] and periodic updates including processes for sustained improvement of energy efficiency;

[33] The MEPS and standards would mainly cover RACHP equipment and foam products in the context of HFC phase-down.

(d) Implementation of labelling and other standards that include Kigali Amendment provisions;

(e) Energy savings as a percentage of baseline levels for the investment projects per unit of equipment for different types of equipment; the impact of energy savings on greenhouse gas (GHG) emissions may be difficult to assess as this would vary depending on the energy source of the locations where the equipment is used (e.g., if the equipment is exported, the importing country's GHG emission intensity will be relevant);

(f) Total number of respondents covered through different training and capacity-building programmes under technical assistance programmes for SMEs and technical assistance programmes for local assembly and installation, and service sector and enforcement officials;

(g) Total number of respondents and programmes implemented for awareness and information outreach activities;

(h) Number of new operators covering energy efficiency (e.g., energy service companies (ESCOs), cooling-as-a-service (CAAS) providers, the number of new energy-efficient component suppliers) resulting from project activities;

(i) Total number of testing centres established and operationalized;

(j) Total number of regional centres of excellence established and operationalized;

(k) Total number of feasibility studies and other projects undertaken, and the impact of such studies/projects;

(l) Trends in sales of energy-efficient equipment by different types of equipment (i.e., domestic refrigerators, residential ACs);[34] and

(m) Feedback on payback for different types of equipment with an explanation regarding general levels of acceptability of payback to the consumers.

81. It is also known that energy-efficiency-related activities in the context of HFC phase-down could have an indirect impact on adoption of other energy-efficient equipment and market transformation (e.g., more market players selling low-GWP energy-efficient equipment, more service providers for such equipment). This information could also be captured in the reports.

82. At the MLF level, information collected from the above indicators will be aggregated and reported as a part of the results framework and the scorecard.

83. While most of the quantitative data reported can be aggregated, some of the data will have to be presented at a disaggregated level with levels of achievement (e.g., investment project energy-efficiency improvement levels, growth in sales for energy-efficient equipment in the context of HFC phase-down) with relevant explanations.

84. Institutional strengthening projects could also cover indicators pertaining to energy efficiency related activities. A periodic assessment of energy efficiency related activities in the different countries by

[34] This needs to be captured by developing a detailed data management system for manufactured/imported equipment and their energy-efficiency levels; since it could take time to implement this system, best estimates of energy-efficient equipment sales by type of equipment could be provided in the interim period.

a subject expert would be helpful in making recommendations on the implementation of these activities in future.

## Part VII: FUNDING WINDOW FOR HIGH-IMPACT TRANSFORMATIVE CHANGE IN COMMERCIAL REFRIGERATION AND RESIDENTIAL AIR-CONDITIONING MANUFACTURING

85. Part VII of the document show cases an example of a funding window for high-impact transformative change in commercial refrigeration and residential air-conditioning manufacturing with super-efficient equipment. This demonstrates how MLF resources could be used for a sectorial approach.

86. Commercial refrigeration and residential air-conditioning applications have high levels of HFC consumption and high energy consumption. Thus, these sectors provide an opportunity not only to achieve high energy savings but also to reduce overall dependence on HFCs in the long run. Further, if the incentives are structured to facilitate the adoption of low-GWP energy-efficient technologies, the availability of such equipment in these applications can be increased expeditiously.

87. As per current policies, KIPs can be submitted by countries to achieve HFC phase-down in line with the compliance requirements; decision 92/44 allows countries to submit projects that reduce HFC consumption in advance of Montreal Protocol targets where they have a strong national commitment in place to support such reductions. A dedicated funding window would help countries that are considering sector phase-out plans for HFC consumption in commercial refrigeration and residential air-conditioning manufacturing with higher levels of energy-efficiency impact.[35] Carving out such funds would ensure that such high-impact projects can be implemented without being subject to competing funding priorities.

88. In light of this, the Executive Committee could consider establishing a funding window for high-impact transformative change in commercial refrigeration and residential air-conditioning manufacturing. The objective of this funding window is to have dedicated funding available for eligible enterprises that are converting from HFCs to equipment using low-GWP alternatives and are adopting energy-efficient technologies at levels (e.g., at least 25 per cent) above the prevailing best available technology levels in the local market.

89. This funding window shall be available subject to the following conditions:

(a) The funding would be available to those projects where KIPs include sectoral conversion in commercial refrigeration and residential air-conditioning, and would take into consideration the funding available under the KIPs;

(b) The energy-consumption performance or energy efficiency at the end of the project should be at least the approved levels for this funding window by the Executive Committee;

(c) Enterprises accessing funds through this funding window could avail of funding up to 25 per cent[36] above the incentive levels agreed by the Executive Committee;

(d) Limits on how much a specific country can access from this funding window could be specified; for example, a country submitting a proposal can submit proposal up to a total funding of US $ [XX] million; and

[35] These two specific sectors are chosen as the consumption of high-GWP HFCs is high and adoption of energy efficient technologies using substances not controlled under the Montreal Protocol could have a significant impact both in terms of reduction in HFC consumption and higher energy efficiency levels.

[36] Based on additional funding that could be provided to low-GWP technologies under decision 74/50.

(e) The project evaluation process and the Government commitment would be the same as for the incentive for energy efficiency provided to the manufacturing enterprises.

90. To ensure that sector phase-down is achieved in a fast-track manner, complementary funding from non-MLF sources may need to be mobilized. This can include national, regional and/or global financial sources (e.g., bilateral funding sources, regional/multilateral development banks, national development financing institutions, private banks). This can cover a range of enterprises dealing with these applications including ineligible enterprises for achieving sectoral transformation.

## CHAPTER 2: OPERATIONAL FRAMEWORK WITH MLF AND NON-MLF FUNDING

### Revolving fund for equipment replacement programme to promote the adoption of low-GWP energy-efficient technologies in RACHP

91. The creation of a revolving fund is considered to provide funding to scale-up the adoption of energy-efficient low-GWP technologies in a country while phasing down HFCs. It is known that, in large size commercial and industrial RAC equipment, investments in RAC equipment with energy-efficient low-GWP technologies could vary depending upon the needs of the end users and the capacity of the equipment. It is also known that higher initial costs of equipment represent a key barrier to the adoption of these equipment.

92. A funding window that would work as a revolving fund to catalyze the adoption of these technologies would help scale-up the adoption of low-GWP-refrigerant-based energy-efficient equipment. This revolving fund can be capitalized with support from the MLF and/or other non-MLF sources and serve as a platform for low-cost financing to promote the adoption of energy-efficient low-GWP technologies.

93. The following aspects need to be considered in order to operationalize the revolving fund.

(a) The funds should be made available to the country through an implementing agency, which would be responsible for assisting the country in utilizing this revolving fund;

(b) The funds should be managed through a national financial institution or equivalent in order to maximize outreach, and the agency implementing the project should establish operational mechanisms for working with the national financial institution in consultation with the NOU. Operationalising this through a national financial institution could result in faster implementation and can reduce the risks of funding as the local financial institutions would have a better understanding of market and clients (i.e., beneficiaries);

(c) The funding should be limited to low-GWP technologies. Structuring the funding priorities should be based on national strategies for achieving HFC consumption reduction;

(d) The funding institution can use this revolving fund, that is available at zero/preferential interest, alongside other commercial loans aimed at promoting low-GWP-refrigerant-based energy-efficient equipment; the operational modalities including project funding approval processes and monitoring and reporting processes should be established and monitored through an appropriate institutional arrangement (e.g., a technical and financial monitoring committee for project monitoring, categories of beneficiaries to be supported);

(e) The duration of use of this revolving fund could be up to 5 years, after which the balances would be returned back to the MLF; based on the initial experience on effectiveness of the revolving funding, future policies and processes associated with the funds could be defined by the Executive Committee;

(f) The governing mechanisms of these funds should include representatives from the national energy-efficiency authority, who should also participate in the KIP implementation monitoring bodies;

(g) Mechanisms for minimising risks for revolving fund defaults need to be defined by the financial institution based on their procedures relating to credit risk assessment. In general, it is expected that this would be subject to credit-worthiness of the borrower; and

(h) At the discretion of the Executive Committee, any funds contributed by the MLF to this revolving fund that cannot be repaid under this project should be adjusted against the remaining consumption eligible for funding for the country at a cost-effectiveness value of US $5.1 per kg (decision 92/37).

94. To begin with, this can be implemented in a limited number of LVC countries for supporting commercial and industrial RAC applications. Based on the performance of these projects, which could be reviewed in few years, the modalities of operationalization could be examined, including whether non-LVC countries could also be supported through a revolving fund.

## Two case studies

95. Two case studies are presented below to illustrate how funding from the MLF and from non-MLF funding sources could be used to achieve faster and scaled-up HFC phase-down. These case studies show how national-level funding institutions can be systematically engaged in HFC phase-down by facilitating the adoption of low-GWP energy-efficient alternative technologies in RACHP applications, thus scaling up the results achieved through MLF funding.

96. It should be noted that the options for such mechanisms would vary depending on country-level industry characteristics, financial markets and countries' plans relating to KIP implementation. For illustration purposes, the two case studies below present specific situations and possible options for easy understanding of how alternative funding modalities can be used.

Case 1: A small island country (population of roughly 0.5 million)

97. The country, whose economy is significantly dependent on fisheries and tourism, is planning to implement a Kigali Implementation Plan for HFC phase-down (KIP) focusing on HFC consumption in air-conditioning equipment (residential and commercial ACs) and industrial RAC equipment (mainly in fisheries and some large central air-conditioning systems). For the energy-efficiency component, the bilateral/implementing agency is considering how other innovative funding options using non-MLF funding can be used for energy efficiency while phasing down HFCs.

98. This country faces a number of challenges when it comes to programme design. Given that it is a small country, the total market size is comparatively small. The market for air conditioning is likely to focus on residential (small split air-conditioning units), hotels (also likely to be split units unless there are larger hotels), and offices (also using small split units). In the fisheries sector, the industrial refrigeration units are likely to be designed for specific installations. There may be a limited number of financial institutions to work with in the country, although there may be a strong presence of international non-governmental organizations. Consumers are extremely price-conscious and have been known to purchase second-hand equipment, which is cheap but significantly less efficient than new devices.

99. To promote the adoption of high-energy-efficiency devices while phasing down HFCs it will be important to design mechanisms that bring down the initial cost of purchasing units to an affordable level, and to persuade consumers that new devices are, in fact, cheaper to operate over their life cycle. This could be achieved using the instruments outlined below.

100. A financial instrument to reduce the retail price of new devices could be structured around a results-based incentive to AC retailers, so that they would be compensated (and rewarded) for increasing sales of low-GWP-refrigerant-based higher-energy-efficient units; this will make it more attractive to retailers who are gaining through sales of higher priced energy efficient equipment. As part of the scheme, there should also be a buy-back scheme to recover and recycle old units and not let them be placed in the market. This would prevent consumers from buying a new AC at low prices but then selling it to other consumers at a higher price, which would result in the continued use of inefficient ACs.

101. It might also be possible to work with one of the few local banks to develop a retail finance product that helps to spread the costs of purchasing AC units over a longer time period. This may entail a multilateral development bank (MDB) providing blended concessional finance to the bank, or perhaps a risk-sharing agreement. The resulting net lower cost of financing could be "transferred" to the retailer to achieve higher sales of low-GWP-refrigerant-based higher-energy-efficient units. If feasible, other "aggregators" could also be engaged in implementing such projects (e.g., electricity supply utilities who could implement "pay as you go" schemes).

102. A key part of such a programme would be an information campaign targeted at residential and commercial users demonstrating the financial benefits (lower operational costs) of choosing an energy-efficient appliance. This could be implemented using grant funding from an interested donor and executed by a national partner. KIP activities implemented with MLF funding can also be used for promoting such products.

103. For the fisheries sector, it is anticipated that installations would be custom-designed and installed by niche project developers that purchase components and install them locally. Given that there may be a relatively small number of such projects, it may be possible to use either working capital loans (possibly using specially extended credit facilities for energy-efficient components) or a revolving fund to provide finance to the developers through a national financial institution with conditions, appropriately designed, to adopt low-GWP energy-efficient technologies. These industry players would have existing relationship with bankers and could have established credit worthiness. The funding schemes can be designed to incentivize the adoption of low-GWP energy-efficient technologies in new installations and/or the replacement of existing installations. Technical assistance available through KIPs and other projects which could be funded from non-MLF sources/equipment suppliers could facilitate the promotion of these technologies.

Case 2: A medium-sized country (population of roughly 30 million)

104. In this country, HFCs are consumed in large quantities in commercial refrigeration equipment (e.g., self-contained commercial refrigeration systems, condensing units). This equipment is either purchased as stand-alone equipment or installed locally, the latter representing a significant proportion of the consumption, in terms of installation and servicing. This consumption is growing due to general economic growth in the country and growth in imports of cheap HFC-based equipment. For the energy-efficiency component, the bilateral/implementing agency and country are considering how other innovative funding options using non-MLF funding can be used for energy efficiency while phasing down HFCs in these applications.

105. There appear to be two major challenges: the threat of cheap HFC-based imports, and the fact that there are many non-standard systems being developed and installed; this aggravates the problem as such non-standard HFC-using equipment could be in service for long durations of time. To deal with the first issue, it is proposed to use regulations relating to the import of equipment to prevent non-standard equipment from being imported. Regulations/codes of practices relating to the installation and use of energy-efficient low-GWP-refrigerant-based equipment also need to be implemented by the relevant regulatory authorities. This would require a technical assistance programme to work with the national Government on developing import standards that would effectively ban imports of low-efficiency/HFC-using equipment and regulations/codes for installing and using energy-efficient low-GWP-refrigerant-based equipment. Given that the country is mid-sized, it may already have an energy-efficiency policy that can be effectively utilized to develop and implement these regulations; further, the country might be open to adopting an energy and environmental standards and labelling programme if it has not already done so.

106. In tandem with the regulatory approach, it would be important to develop mechanisms for making low-GWP energy-efficient equipment more affordable and more easily available to consumers. This could

be achieved by working with retailers and utilities on consumer finance schemes such as on-wage financing, or on-bill financing. Such programmes have already attracted non-MLF donor interest.

107. To deal with the growing number of non-standard, and likely larger installations, it is proposed to engage with at least two local commercial banks. The proposition for the banks would be that there is a growing number of investments of a reasonable size that may not already be served, or that represent opportunities coming from their existing client base. These banks generally have mechanisms to assess credit worthiness and credit risk management processes for different end users in the said applications. To address any hesitation around serving the new market (i.e., energy-efficient low-GWP refrigerant technologies) because of perceived risks, it is proposed to work with a MDB, experienced in energy-efficiency lending, to offer risk-sharing facilities to the local banks. Such an instrument would need the support of a principal donor to provide risk capital to the MBD, as well as funds for a technical assistance programme to support the local banks in originating and evaluating project proposals. Additional support from KIP funding for awareness and capacity building can be provided to encourage the banks and end users to adopt low-GWP energy-efficient technologies.

# CHAPTER 3. SUMMARY AND RECOMMENDATION

## Summary

108. Support for manufacturing energy efficient compressors and heat exchangers for low-GWP energy efficient equipment, regional or national testing centres for domestic refrigerators, commercial refrigeration equipment and residential and commercial air-conditioners, regional centres of excellence to support SMEs that manufacture equipment and enterprises that undertake local installation and assembly in adopting energy-efficient technologies, feasibility analysis for district cooling and for retrofitting large RAC systems with energy-efficient alternatives, are additional activities beyond those included in paragraph (b)(i) of decision 91/65. These activities were identified based on additional inputs received from the agencies, and on project activities relating to energy efficiency submitted pursuant to decisions 89/6 and 91/65 over the last 12 months. Other activities could also be submitted based on the needs at the national and regional levels and be considered on a case-by-case basis.

109. The operational framework considers funding support for investment (manufacturing of equipment and manufacturing of components) and non-investment activities. It also considers two types of funding modalities, the incentive-based approach and the activity-output-based approach. While the former would be applicable for equipment manufacturers and would be paid primarily based on achievement of energy performance levels, the latter would be based on activity levels. The incentive-based approach is used only for manufacturing equipment, all other activities are proposed to be funded based on the activity-output-based approach.

110. The additional costs for manufacturing equipment would include additional investment costs and the cost of components. The costs would vary depending on the manufacturing capacity of enterprises, the type of equipment manufactured, the baseline energy-efficiency situations and the energy-efficiency levels expected to be achieved through different interventions (e.g., adopting variable speed compressors in place of fixed speed compressors, improved heat exchangers and energy-efficient fans and motors). The costs are estimated based on standard product categories and with the assumption that the components for manufacturing energy-efficient equipment would be outsourced.

111. Additional costs for manufacturing components would include investments in product design, prototyping and testing, modifications in manufacturing facilities and training-related activities. This would vary depending on the types of components (e.g., in the case of heat exchangers, whether the component is FTHX or MCHX) and based on manufacturing capacity of enterprises. Compressors and MCHXs are generally outsourced from component manufacturers and these component manufacturers have technical resources that enable new product design and development.

112. Technical assistance to SMEs is considered essential to help them adopt energy-efficient technologies and components. The SMEs continue to manufacture a lot of RACHP equipment in Article 5 countries and have limited technical and financial resources. Support to SMEs in adopting energy-efficient technologies is critical to ensure the timely and sustainable implementation of policies and other measures for energy-efficient equipment and to ensure that the continuity of SMEs' business operations is not affected. The funding support could vary depending on the number of SMEs proposed to be supported. The funding modality can provide a fixed amount for technical information outreach and awareness workshops and another fixed amount for training and technical support for the design and adoption of energy-efficient technologies.

113. Enterprises engaged in local installation and assembly provide assistance to a range of end users (e.g., supermarkets, cold stores, central air-conditioning installations in commercial complexes) whose equipment is in operation for several years. Adopting low-GWP energy-efficient technologies would help reduce these end users' dependence on high-GWP HFC-based equipment in the long run; further, the end-users will also benefit from the energy-efficient operation of this equipment. This industry sector is

widespread and generally not controlled under regulations and information on the number of enterprises in this sector is sparse or even unknown. Support provided to this sector would facilitate the systematic transition of large installations to low-GWP energy-efficient technologies. The funding modality can provide a fixed amount for technical information outreach and awareness activities and another fixed amount for technical training and other measures to support the adoption of energy efficient technologies.

114. Support for the servicing sector is essential to ensure the proper installation, maintenance and servicing of equipment, and would directly contribute to maintaining the energy efficiency of the equipment. Training on good servicing practices and other capacity building measures is already implemented under the HPMPs and KIPs. The status of implementation of different activities under the HPMPs and KIPs offer opportunities for maximizing synergies while implementing energy-efficiency-related project components. Keeping in view these considerations and recognizing the importance of supporting the servicing sector in adopting practices to maintain the energy efficiency of equipment, as well as the need for flexibility in responding to the national circumstances for activities relating to the servicing sector, the funding requirements for maintaining energy efficiency could be considered at a percentage of the levels agreed under decision 92/37 for countries with a consumption of less than 360 mt of HFCs in servicing in the baseline years and at pre-defined levels for countries with consumption above 360 mt, on the understanding that the training activities for the servicing sector shall only be provided under the KIP and any additional activities relating to energy efficiency in the servicing sector would be those mentioned in paragraph 55 (a) to (d) above.

115. The need for testing centres, national and/or regional, was highlighted during different discussions in the context of energy efficiency in RACHP equipment. These testing centres or equivalent models for verifying the energy efficiency of RACHP equipment are essential for enforcing the energy-efficient performance of equipment. A viable business model is critical for the sustainable operation of such testing centres if the Executive Committee agrees in including those under the operational framework. A viable business model is also essential for the operation of regional centres of excellence which primarily assist in capacity building for SMEs related to the design and development of energy-efficient equipment. These centres can also play a larger role in facilitating the supply of low-GWP-refrigerant-based energy-efficient equipment and the components for such equipment (e.g., acting as centres for networking with component suppliers, acting as consolidators for bulk procurement of equipment).

116. Funding the feasibility studies for district cooling projects and for retrofitting existing equipment with energy-efficient alternatives can provide opportunities for the adoption of energy-efficient low-GWP refrigerant technologies on these high impact projects. Although the contribution of the Fund will be limited to the feasibility studies, these studies can act as a catalyst for these projects with large funding requirements and complex business models, depending on their size. Strong national commitments through policies and regulations and/or a robust business model would be needed to ensure the successful implementation of these projects. Such commitments could be considered as pre-conditions for consideration of the feasibility studies.

117. Energy efficiency in RACHP equipment results in payback to the end-users. The levels of payback primarily depend on usage characteristics, the price of electricity, and the additional cost of such energy-efficient equipment. While the manufacturers who produce equipment indirectly benefit from payback (i.e., higher sales of energy-efficient equipment which could be higher in price), they do not directly obtain any gains from higher payback. This needs to be taken into account when defining incentives for manufacturers to manufacture energy-efficient equipment.

118. In line with decision 91/65(b)(iii) requesting the Secretariat to present funding modalities, the Secretariat has presented a range of incentive levels for enterprises manufacturing equipment; the incentives should be linked to the other conditions that would guide effective implementation and achievement of desired outputs/outcomes on energy efficiency levels. The specific levels of incentives would be based on the final decision of the Executive Committee and associated conditions. For activities not relating to

manufacturing of equipment, the additional costs for achieving outputs from specific activities could be considered; a payment schedule that would have most of funding provided on approval of the project and a lower portion of the total payment to be paid on confirmation of satisfactory achievement of outputs/outcomes could be considered; this is similar to how payment schedules were approved during HPMPs. Front-loaded funding is proposed so that the available funds can be made available to the countries in advance for implementation of project activities.

119. The monitoring and reporting for evaluation of projects would involve monitoring and reporting at project level, country level and MLF level. Since there could be other projects implemented in the country, with MLF and non-MLF funding support, that would also have a bearing on the outcomes under the energy efficiency related aspects, the monitoring and reporting process needs to take into account these impacts, and the reporting should ensure a holistic approach. This has been explained in part VI of the document.

120. A special funding window targeted at HFC consuming sectors that have high GWP impact on HFC consumption and high growth is considered for projects that have high impact in terms of HFC consumption reduction and adoption of energy-efficient technologies.

121. A revolving fund is considered as an alternative funding approach with non-MLF funding as part of the operational framework. The revolving fund will include funding from MLF that would be combined with funding from other non-MLF sources and used for providing low-cost funding support for converting to energy-efficiently low-GWP refrigerant-based technologies in commercial and industrial RAC sector. This needs to be operationalised through a financial institution.

122. To illustrate how energy efficiency related alternative funding models could work, two case studies are presented. The two studies present theoretical cases on two situations relating to adoption of energy efficient technologies, challenges and barriers relating to the industry structure and possible approach(es) to address these barriers. It must be noted that for sustainability of energy efficiency in the context of HFC phase-down in RACHP applications, models involving national financial institutions need to be considered with necessary support through capacity building, regulations and other relevant measures. This will result in systematic adoption of such technologies while phasing down HFCs.

## Recommendation

123. The Executive Committee may wish:

(a) To note the information provided in the report on operational framework to further elaborate on institutional aspects and projects and activities that could be undertaken by the Multilateral Fund for maintaining and/or enhancing the energy efficiency of replacement technologies and equipment in the manufacturing and servicing sectors when phasing down HFCs (decision 92/38(a)), contained in document UNEP/OzL.Pro/ExCom/93/98; and

(b) To take into account the information provided in the report referred to in subparagraph (a) above, when considering a path forward for the operational framework for maintaining and/or enhancing energy efficiency of replacement technologies and equipment in the manufacturing and servicing sectors when phasing down HFCs.

# Annex

## EXTRACT – ACTIVITIES INCLUDED IN DECISION 91/65(b)(i) RELATING TO PILOT PROJECTS TO MAINTAIN AND/OR ENHANCE THE ENERGY EFFICIENCY OF REPLACEMENT TECHNOLOGIES AND EQUIPMENT IN THE CONTEXT OF HFC PHASE-DOWN

Activities relating to pilot projects to maintain and/or enhance the energy efficiency of replacement technologies and equipment in the context of HFC phase-down:

Manufacturing activities

a. Conversion projects to maintain and/or enhance energy efficiency while converting from HFCs in the manufacture of domestic refrigeration, stand-alone commercial refrigeration, residential and commercial air-conditioning and heat-pumps would be considered in priority;

b. Conversion projects in other sectors, such as mobile air-conditioning and transport refrigeration, would be considered on a case-by-case basis;

Assembly and installation activities of large commercial and industrial refrigeration, air-conditioning and heat-pump equipment

c. Projects involving technical assistance for the assembly and installation of equipment that would result in the adoption of technologies to maintain and/or enhance energy efficiency while converting from HFCs and demonstrate replicability and scalability in the country or region would be considered in priority;

Servicing activities

d. Projects in the servicing sector including, but not limited to, activities identified in decision 89/6(b) would be considered in priority in the context of Kigali HFC implementation plans (KIPs), except for those activities that had already been funded under decision 89/6(b) in the context of the HCFC phase-out management plan for the country in question;

Technical assistance for small and medium-sized enterprises (SMEs) in manufacturing and assembly/installation

e. Projects involving technical assistance for SMEs to support the adoption of energy-efficient technologies and alternatives while phasing down HFCs would be considered on a case-by-case basis, provided that such technical assistance projects assisted beneficiaries in maintaining and/or enhancing energy efficiency while phasing down HFCs.