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THE MULTILATERAL FUND FOR THE
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**REPORT ON THE LOCAL INSTALLATION AND ASSEMBLY SUBSECTOR,
INCLUDING TYPES OF EQUIPMENT AND REFRIGERANTS AND CHALLENGES IN
TRANSITIONING TO LOW-GLOBAL-WARMING-POTENTIAL ALTERNATIVES
(decision 91/39(b))**

Introduction

1. The issue of consumption of HFCs in the local installation and assembly subsector was raised at the 91st meeting during the consideration of stage I of the Kigali HFC implementation plan (KIP) for the Niger.² During the discussion on the matter it was suggested that additional data on the subsector be collected as there appeared to be a significant level of consumption in that sector in the Niger, although in the project proposal it was not identified separately from consumption for servicing. It also seemed that the level of consumption in that subsector was likely to be higher for HFCs than for CFCs and HCFCs. The Executive Committee therefore requested the Secretariat to prepare a document, for consideration at the 92nd meeting, that provided a description of the local installation and assembly subsector, identifying to the extent possible the types of equipment manufactured and refrigerants used that characterized that subsector as well as the challenges in transitioning to low-global-warming-potential (GWP) alternatives (decision 91/39(b)).

Previous policies related to the local installation and assembly subsector

2. At the 31st meeting, in the context of CFC phase-out, the Executive Committee adopted guidelines for the definition of the subsector for the assembly, installation and charging of refrigeration equipment to differentiate it from commercial refrigeration manufacturing.³ The guidelines characterized the enterprises to be considered under this subsector as follows:

¹ UNEP/OzL.Pro/ExCom/92/1

² UNEP/OzL.Pro/ExCom/91/48

³ Decision 31/45(a)

- (a) The activities of the enterprise involve the assembly or installation of prefabricated refrigeration systems in cold rooms or trucks, or the installation of air-conditioning (AC) systems obtained from specialized suppliers in trucks or buses;
- (b) The installation is outside the premises of the refrigeration equipment manufacturer or may be undertaken by a branch, agency or independent contractor;
- (c) The individual installation may be CFC or non-CFC, based on the refrigerant specified by the manufacturer of the refrigeration unit or based on the choice of the customer;
- (d) It may be impractical to establish production capacity prior to July 1995 or to identify likely levels of production (and thus consumption) in future years as there is no production line; and
- (e) There is no consumption for manufacturing as an intermediate good.

3. The guidelines also established that, for enterprises falling within this subsector, the assistance for the conversion of the refrigeration part would be based on capital costs only.⁴

4. At the 62nd meeting, the Secretariat noted that some HCFC phase-out management plans (HPMPs) for low-volume-consuming countries included technical assistance activities within a subsector plan for refrigeration equipment assembly, installation and charging, requiring funding over and above the level allowed for the servicing sector in the cost guidelines, while in other HPMPs it appeared that the related activities had been subsumed into the servicing sector.

5. Noting that the guidelines contained in decision 31/45 had been prepared to differentiate between the assembly, installation and charging subsector and the refrigeration manufacturing sector, but did not establish a similar distinction in relation to the refrigeration servicing sector, the Secretariat presented an analysis for the Executive Committee's consideration to establish such a distinction. The Secretariat also requested the Committee's guidance on whether and to what degree it wished to fund activities in the assembly, installation and charging subsector *vis-à-vis* treating those activities as part of the servicing sector.

6. The analysis submitted to the 62nd meeting established that the enterprises installing, assembling and charging refrigeration equipment might be grouped by the degree to which they had undertaken technology-specific investments into equipment, development and training of personnel. For example, manufacturers in the AC sector that bought kits, and then assembled and charged them on-site, were considered to fall under manufacturing for funding purposes, whereas enterprises/technicians that installed ready-to-charge or pre-charged split AC units by connecting the indoor with the outdoor units were to be considered under servicing, given that this work required a minimum of know-how and tools/equipment and was undertaken by servicing technicians.

7. Based on the analysis, the Secretariat proposed that, where investments in technology and equipment were typical for the servicing sector, the enterprises undertaking them should be subsumed into the servicing-sector activities at the same funding level. Conversely, where the agency could demonstrate in the submission that the level of HCFC technology, specific investments into equipment, development of products, or training of personnel required funding levels significantly exceeding those prevalent in the servicing sector, funding should be provided beyond the levels foreseen for the servicing sector, covering the incremental capital costs of conversion. Accordingly, the Committee decided to request the bilateral and implementing agencies, when submitting projects related to the installation, assembly and charging subsector, to demonstrate that every enterprise participating in the project had invested in equipment,

⁴ Annex X to document UNEP/OzL.Pro/ExCom/31/61

development of products, or training of personnel specific to HCFC technology significantly exceeding the level of such investments prevalent in the servicing sector; and that the activities foreseen for those enterprises represented incremental costs (decision 62/14).

Relevance of the local installation and assembly subsector

8. The main difference between typical refrigeration servicing operations and the local installation, assembly and first charge of equipment is in the choice of technology. While servicing operations relate to the already operating systems specifically designed to work with already selected refrigerants, local installation and assembly relates to new systems only, where there is still a choice of technology.

9. Hardly any data is available regarding the level of HCFCs or HFCs used in the local installation, assembly and first charge of new refrigeration and air-conditioning (RAC) systems across Article 5 countries. In fact, the use of HCFC-22 for the installation and initial charge of RAC equipment is absent from almost all HPMPs, and all consumption that was not associated with manufacturing has been attributed to the refrigeration servicing sector. In discussing the experience gained by the bilateral and implementing agencies in the implementation of HPMPs during the Inter-agency coordination meeting,⁵ it was observed that a better understanding of this subsector could facilitate the HFC phase-down, favour the introduction of low-GWP technologies, and promote safe and energy-efficient installation practices.

10. Separating refrigerant consumption for servicing from that for the local installation and assembly subsector would require an estimate of the number of systems installed annually, with refrigerant charge amounts, versus the total fleet of systems (which requires an average life-time estimate) and leak-rate estimates; however, this type of information is not readily available. It is expected that more information on this subsector may become available as Article 5 countries collect HFC consumption information during the preparation of their KIPs.⁶

Characterization of the local installation and assembly subsector

11. This report sets out to characterize the installation and assembly subsector, and to differentiate the enterprises operating in this subsector from the manufacturing-only and the servicing-only enterprises.

Types of enterprises

12. The installation and assembly subsector comprises several types of enterprises that install, assemble, and charge on-site refrigeration or AC systems designed and tailor-made from components purchased from suppliers. Enterprises in this subsector are generally locally owned and predominantly small and medium-sized, designing and installing cold stores and single cabinets with remote condensing units, but can also include large enterprises with in-house design departments that design and install complete supermarket systems with machine rooms, multiple display racks and online monitoring.

13. Enterprises in this subsector typically offer after-sales services, including maintenance contracts and repair services, and will have at least one staff member with the technical expertise to size and select components based on the selected refrigerant and required cooling capacity. Larger enterprises may have an engineering or design department to accommodate requests for larger and more complex equipment, e.g., in supermarkets or industrial applications. For many enterprises, servicing the installed systems is an essential part of their business. For more complex systems this is even more relevant due to the know-how involved, and the after-sales service can even include online monitoring of the installed systems.

⁵ Montreal, 8-9 March 2023

⁶ Decision 91/39(a) encouraged Article 5 countries and implementing agencies, in the context of HFC surveys conducted during preparation of KIPs, to collect information on and provide estimates of any HFC consumption in the local installation and assembly subsector, when it was possible to do so and on a voluntary basis.

14. Larger enterprises that not only manufacture but also install and assemble RAC systems locally should be considered as manufacturers; in the case of such enterprises it is unlikely that a significant proportion of the installed systems would be produced by another supplier.

15. Non-Article 5 owned enterprises and enterprises that export more than 10 per cent of their systems to non-Article 5 countries are excluded from the subsector.

Types of refrigeration and air-conditioning systems installed

16. The enterprises in the installation and assembly subsector provide systems to a wide range of end-users, including retailers such as supermarkets, minimarkets and butcheries; the agroindustry, including flowers, food-freezing warehouses, slaughterhouses, and milk-based products; the pharmaceutical sector; catering services for *inter alia* the army, schools, hospitals, restaurant chains, food processing plants, the fisheries industry, and hotels and office buildings, among others. Table 1 lists the types of RAC systems considered to be part of the local installation and assembly subsector by application, indication of cooling capacity, and the currently used and alternative refrigerants. Noting that a key characteristic of the subsector is that charging is done on-site and not in a manufacturing facility, for applications where both charging possibilities exist, systems that are charged at a manufacturing facility are excluded from the subsector.

Table 1. RAC systems considered to be part of the local installation and assembly subsector*

Equipment type and description	Application examples	Cooling capacity (kW)	Typical refrigerants in use (Article 5)	Examples of alternative refrigerants
<u>Commercial split systems</u> : an evaporator connected to a remotely located compressor and condenser (condensing unit)	Commercial: convenience stores or shops;** walk-in cold rooms; restaurants**	>2	<ul style="list-style-type: none"> • R-134a • R-404A • HCFC-22 	<ul style="list-style-type: none"> • HFC blends (e.g., R-448A, R-513A) • HFO-based blends (e.g., R-454A, R-457A) • R-290 • R-1270 • CO₂
<u>Commercial centralized systems</u> : several cooling evaporators connected to a remotely located compressor rack and external condenser (direct systems)	Commercial: food display cabinets in supermarkets	>40		
<u>Industrial small and medium-sized systems</u> : for single cooling loads	Industrial: food and beverage processing, pharmaceutical manufacturing, cold storage	>20	<ul style="list-style-type: none"> • R-134a • R-404A • R-507A • HCFC-22 	<ul style="list-style-type: none"> • HFC blends (e.g., R-448A, R-513A) • HFO-based blends (e.g., R-454A, R-471A) • HFO-1234yf • R-290 • R-1270 • NH₃, CO₂
<u>Industrial large distributed refrigeration systems</u>		100-2,000		
<u>AC split systems, either ducted or non-ducted</u>	Single room** to large halls, residential buildings**	5-1,000	<ul style="list-style-type: none"> • R-410A • R-407C • HCFC-22 	<ul style="list-style-type: none"> • HFC blends (e.g., R-454B) • HFO-based blends (e.g., R-454A) • HFC-32, R-290
<u>Large AC systems</u>	Packaged rooftop systems**	12-200	5-10	<ul style="list-style-type: none"> • R-407C, R-410A

* Information from <https://ozone.unep.org/meetings/workshop-hydrofluorocarbon-management-2015/presession-documents>

** Factory-charged equipment in this category is excluded from the subsector.

17. The RAC systems covered by the local installation and assembly subsector, as shown in table 1, are charged on-site.⁷ Factory-sealed systems, such as domestic refrigerators, stand-alone commercial refrigerators and window air conditioners are not covered by the subsector, and neither are pre-charged small split AC units that only require the connection of the indoor with the outdoor unit on-site. Large industrial refrigeration equipment and transport refrigeration equipment is usually manufactured, installed and maintained by manufacturers or technically competent enterprises, and therefore are not covered by this subsector either.

Activities in the subsector and requirements to convert to low-global-warming-potential technologies

18. Enterprises in the local installation and assembly subsector may conduct a combination of the following activities:

- (a) Designing commercial RAC systems tailored to the customer's requirements for refrigeration or cooling based on the installation's location and other conditions of the environment. This may include selecting an appropriate refrigerant in consultation with the customer, selecting the correct type of components (e.g., compressors, evaporators and condensers, pipes and valves), calculating/designing the specification (capacity, pressure, and other parameters) of each component and providing the design documents (including blueprint);
- (b) Purchasing components based on the design specification; assembling, installing and charging the system at the customer-designated location; conducting trials and testing; adjusting the installed systems to optimize their performance; training staff in system operation; and
- (c) Regularly inspecting, maintaining and servicing equipment, diagnosing problems, and recharging refrigerant in the event of leaks (after repair) to enable the installed systems to operate at optimum conditions to achieve the designed energy efficiency.⁸

19. The tools and equipment required for conducting local installation and assembly are typically not very different from those required for servicing the same systems. For large, complex systems additional tools are needed (e.g., cranes, welding equipment), but these are generally not related to the choice of refrigerant. For many systems, refrigerant-related servicing tools are similar, and include inter alia scales, manifold gauges, and leak detectors, with the exception of specific tools used to handle flammable and/or toxic refrigerants, including leak detectors and fire-proof vacuum pumps, which are not always required for enterprises handling high-GWP HFCs.

20. Support to convert local installation and assembly enterprises to low-GWP alternatives would include technical assistance, capacity building, and training of staff in the design of systems using alternative technologies and in the handling of alternative refrigerants that are flammable, toxic and under high pressure. The expertise required to select the appropriate components, and design and properly undertake installation of new assembled RAC systems is higher than that required for the servicing of installed RAC equipment; therefore, training and technical assistance need to be tailored to the needs and expertise level of the enterprises in the subsector. In addition, the cost of components associated with low-GWP technologies may be higher and may also be taken into consideration. Additional technical assistance and information sharing may be needed to help smaller enterprises establish the necessary supply chains to secure the components required for low-GWP refrigerants.

⁷ Excluding refrigerant top-up when installing split units on-site.

⁸ Although these activities are performed by the enterprises falling within the local installation and assembly subsector, the associated consumption should be considered under the servicing sector.

Challenges in converting to low-global-warming-potential alternatives

21. As in the case of manufacturing enterprises, some of the challenges faced by enterprises in the local installation and assembly subsector when it comes to adopting low-GWP alternatives include the lack of standards for RAC equipment and components based on refrigerants that are flammable, toxic or under high pressure; wider availability and lower cost of RAC equipment and components based on high-GWP HFCs; the lack of regulations or policies to incentivize the uptake of low-GWP technologies or disincentivize the use of high-GWP technologies; and the hesitancy of customers to use flammable or toxic refrigerants due to safety concerns. In addition, challenges that are specific to enterprises in the local installation and assembly subsector include:

- (a) Difficulties in obtaining the enterprises' commitment to only use low-GWP technologies, due *inter alia* to inadequate training on safety resulting in improper technology transfer; low availability and higher prices of some alternative refrigerants and associated components; and the risk of market share loss to competitors where the use of low-GWP alternatives is not required for all relevant installations;
- (b) Limited technical capacity to handle new low-GWP technologies;
- (c) Limited ability to influence supply chains to secure the components necessary for low-GWP technologies; and
- (d) Difficulties in identifying enterprises in the sector, making a subsector-based transition challenging as converted enterprises may continue to compete with enterprises that have not yet transitioned.

22. In view of these challenges, assistance to these enterprises should be provided in conjunction with other activities implemented under the KIPs, including policy and regulatory measures to facilitate the adoption of low-GWP technologies and disincentivize the use of high-GWP technologies; the adoption and updating of standards where relevant; awareness raising among end-users; and technical assistance to the servicing sector, importers, and distributors to increase the availability of alternative technologies and components. Furthermore, projects addressing the end-users of specific RAC applications supplied by the local installation and assembly subsector should be implemented in conjunction with technical assistance to enterprises in this sector to develop the local capacity to design, install and service the demonstrated systems.

23. The sustainability of conversions in this subsector is strengthened when undertaken in a strategic manner that takes into account the application-specific local market conditions and regulatory framework, availability of low-GWP refrigerants and components, and technical capabilities of local industries. For example, in the early stages of any country's KIP, enterprises in this subsector may be unable to transition to only assembling and installing low-GWP-based equipment in all applications, but may be able to commit to only assembling and installing low-GWP-based systems in specific applications, if policy or regulatory controls on those applications are introduced (e.g., a ban or another measure restricting the installation of HFC-based supermarket display cabinets below a specified cooling capacity).

Conclusion

24. Based on the previously established definition and on the analysis of the types of enterprises, activities, and types of RAC systems presented in this document, enterprises in the local installation and assembly subsector can be characterised as follows:

- (a) The enterprise designs and/or selects, assembles, and installs prefabricated components in the commercial or industrial refrigeration applications or in AC systems;

- (b) The enterprise performs the assembly, installation, and charging of refrigerant at the location designated by the end-user, and is distinct from the manufacturer of the installed components or unit;
- (c) The refrigerant to be used for the individual installation shall be based on the refrigerant specified by the manufacturer of the unit or components, the choice of the customer or the choice of the installer;
- (d) It is impractical to establish a manufacturing capacity as there is no manufacturing line, but it is possible to establish the consumption of refrigerants over the last three years for the purpose of installing and charging RAC systems on-site;
- (e) There is no refrigerant consumption at a manufacturer site prior to installation; and
- (f) The enterprise needs to invest in equipment, product development, or training of personnel specific to HFC technology at a level exceeding those investments prevalent in the servicing sector.

25. Addressing this subsector could facilitate the introduction of low-GWP technologies during HFC phase-down and promote safe and appropriate installation practices to optimize energy-efficient operation of the systems. Support to this subsector would depend on the characteristics and needs of the involved enterprises, and would mainly include technical assistance, capacity building, provision of tools and training to staff to design, install and handle systems using alternative technologies, which may be flammable, toxic and under high pressure, assistance. In addition, assistance to help establish the necessary supply chains for required components associated with low-GWP technologies, and to cover their possible higher prices may be required. Activities addressed to end-users such as demonstration of RAC systems using low-GWP technologies may also facilitate the market uptake of such systems and contribute to the conversion of those enterprises.

26. In view of the potential challenges listed in paragraph 21, this assistance should be provided in conjunction with other activities in the KIPs. In order to be sustainable, such activities could either address the consumption of specific applications or, where possible, the subsector in its entirety. Strategies that address enterprises in the local installation and assembly subsector along with major end-users may provide opportunities to facilitate the adoption of low-GWP alternatives.

RECOMMENDATION

27. The Executive Committee may wish to note the Report on the local installation and assembly subsector, including types of equipment and refrigerants and challenges in transitioning to low-global-warming-potential alternatives, contained in document UNEP/OzL.Pro/ExCom/92/49.