GUIDANCE NOTE

Assessing greenhouse gas emissions from refrigerants use in UNDP operations

Developed by UNDP Montreal Protocol and Chemicals and Waste Management Unit and Greening Moonshot

July 2022

Contents

Acronyms

AC	Air Conditioner
CFC	Chlorofluorocarbon
CO_2e	Carbon Dioxide equivalent
EMT	Environmental Management Tool
IEA	International Energy Agency
GHG	Greenhouse gas
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt hour
MPU	UNDP’s Montreal Protocol and Chemicals and Waste Management Unit
ODP	Ozone depleting potential
RAC	Refrigeration and Air Conditioning
US EPA	United States Environmental Protection Agency
WRI	World Resources Institute

Introduction

As a leading agency in the fight against climate change, UNDP is walking the talk on climate action and has adopted ambitious Moonshot Targets committing to reduce the carbon footprint of global UNDP operations by 25% by 2025 and 50% by 2030. To monitor progress towards these targets consistently and to conclude credible greenhouse gas (GHG) emission reduction claims, UNDP has developed an Environmental Management Tool (EMT). The EMT simplifies the reporting process for all UNDP offices and therewith improves overall reporting compliance and accuracy. It generates an environmental report for every contributing office, which allows offices to analyze and compare their performance and take targeted 'green' action where most impact can be achieved. UNDP has been publicly disclosing the environmental impact of its global operations since 2009, as part of the UN-wide annual Greening the Blue report.

To engage all UNDP offices in the reporting process and to minimize the reporting burden, the EMT was designed to focus on data accuracy for the 'big' emission sources in UNDP operations – in particular air travel, electricity consumption and fuel use – and apply simplified proxy approaches for smaller sources, including refrigerant emissions. This approach has two shortcomings:

1) Results are inaccurate and not credible; and
2) Progress cannot be tracked accurately, taking climate action is not 'rewarded' by lower carbon footprint results.

UNDP's Montreal Protocol and Chemicals and Waste Management Unit (MPU) provides technical support and guidance to countries in meeting their obligations under the Montreal Protocol. The implementation of the Kigali Amendment under the Montreal Protocol could prevent 0.4°C of global warming this century[1]. UNDP is committed to "walk the talk" and to assess, monitor, and take steps to reduce GHG emissions of from cooling[2] assets used in its facilities and vehicles.

Therefore, an updated approach to assessing and monitoring GHG emissions from refrigerant use in UNDP operations has been developed and adopted as laid out in this document.

The purpose of this document is:

1. To describe the methodology adopted by UNDP to assess CO_2e emissions caused by direct emissions of refrigerants from refrigeration and air conditioning (RAC) appliances and vehicles at its facilities, and
2. To provide a step-by-step guidance to relevant UNDP staff (generally Operation Managers and EMT reporting Focal Points) on how to apply this methodology. This guidance is intended for the use of UNDP Operation Managers and EMT Focal Points when reporting on direct GHG emissions from RAC assets, but it can also be useful to operations/facility managers or carbon accounting experts outside of UNDP.

This guidance document has been developed by the UNDP MPU with support from the UNDP Greening Moonshot team and an independent RAC expert Mr. Mads Giltrup. This guidance will be reviewed regularly by the Moonshot Team/MPU and updated/revised as necessary.

[1] From the UN Secretary-General António Guterres' message for the International Day for the Preservation of the Ozone Layer on 16 September 2021 https://www.un.org/press/en/2021/sgsm20901.doc.htm

[2] Also referred to as refrigeration and air conditioning (RAC).

Context

According to the International Energy Agency (IEA)[3], the energy demand for cooling more than tripled between 1990 and 2018 to around 2,000 terawatt hours of electricity. The Economist Intelligence Unit[4] estimates that 4.8 billion of new units of cooling equipment will be sold globally between 2019 and 2030. It is estimated that the number of cooling units sold in 2030 will be equal to 460 million units compared to 336 million in 2018. The associated increase in GHG emissions from the use of these appliances will further exacerbate the pace of climate change.

According to recent research[5], total GHG emissions associated with space cooling and refrigeration are equal to approximately 4,400 million tonnes of CO_2e, corresponding to over 10% of global GHG emissions.

Meeting refrigeration and air conditioning demand results in high levels of emissions of GHGs through two pathways: The first pathway is the direct emissions of highly potent GHGs used as refrigerants in most refrigerators, air conditioners and vehicles. The second pathway is indirect emissions through the substantial electricity/energy used to operate refrigerators and air conditioners. It is estimated that 29% of the climate impact from RAC equipment comes from direct emissions and 71% is through indirect emissions resulting from the electricity use based on fossil fuels.

Please note that the indirect emissions due to electricity/energy consumption of cooling assets are **not** covered by the methodology described in this document and are captured under the Facility/Electricity section in the EMT. GHG emissions from electricity use are calculated by multiplying electricity consumption (in kWh) with emission factors for national electricity grids (kg CO_2e/kWh) provided by IEA. In offices where electricity is (additionally) provided through generators, GHG emissions are calculated as generator gasoline/diesel consumed multiplied by a fuel-specific emission factor.

Overview of the methodology for calculating direct GHG emissions from refrigerants

The methodology used in the EMT is based on the '2019 Refinement to the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories[6]', the 'Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (GHG Protocol)' developed by the World Resources Institute (WRI)[7], and US EPA 'Greenhouse Gas Inventory Guidance on Direct Fugitive Emissions from Refrigeration, Air Conditioning, Fire Suppression, and Industrial Gases[8].

UNDP adapted WRI, EPA, and IPCC's methodology, considering the challenges of collecting precise data by UNDP staff who may not have a specialized knowledge of the RAC equipment. It should also be noted that UNDP occupies mostly leased buildings and often relies on third parties to provide data on refrigerants and other data relevant for carbon footprint reporting. This revised methodology was piloted and validated with the participation of ten UNDP offices in May 2022.

[3] "The Future of Cooling, IEA, 2018 https://www.iea.org/fuels-and-technologies/cooling?utm_content=bufferbb0bd&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer
[4] The Cooling Imperative: Forecasting the size and source of future cooling demand. The Economist Intelligence Unit http://www.eiu.com/graphics/marketing/pdf/TheCoolingImperative2019.pdf
[5] https://www.annualreviews.org/doi/full/10.1146/annurev-environ-012220-034103#abstractSection
[6] https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/
[7] https://ghgprotocol.org/sites/default/files/hfc-cfc_0.pdf
[8] https://www.epa.gov/sites/default/files/2015-07/documents/fugitiveemissions.pdf

For the purpose of this methodology, cooling/RAC equipment will be referred to as "cooling assets", thereby covering both facility and vehicle assets. Different types of cooling assets covered under each asset category can be found in Annex I, table 6.

During the lifetime of a cooling asset, direct emissions of refrigerants occur during the manufacturing process, operation, and use of the product, and finally at disposal of the product. Since UNDP facilities are not engaged in the manufacturing processes, it should be noted that the adapted methodology does not consider emissions during the manufacturing process. Annual direct emissions are calculated from the year of installation/procurement of the cooling asset at a UNDP facility until disposal/recycling or sale of the cooling asset. Considering the potential significant leakage from assets after disposal, impacts after disposal are taken into consideration where UNDP disposes of its assets. However, where assets are sold or otherwise transferred to third parties, and UNDP has no control over end-of-life impacts, leakage during disposal is not taken into consideration and only the operating emissions during the reporting period are considered.

Each cooling asset uses a certain type and quantity of refrigerant. Each refrigerant has a specific Global Warming Potential (GWP), which is measured in equivalents of CO_2 emissions (CO_2e). As table 1 shows below, GWPs of refrigerants are often hundreds or thousand times higher than that of CO_2 (GWP value for one tonne of CO2 = 1[9]) – which is why even a small amount of these emissions should be monitored and managed carefully.

Table 1: Overview of most frequently used refrigerants. For a more detailed list, please refer to Annex I.

Refrigerant	**GWP value (100 year)[9]**
R12	11,200
R22	1,960
R134a	1,530
R410A	2,256

For cooling assets in operation, the emissions of refrigerants mainly occur due to leaks from the refrigeration system and during the servicing and repair of the cooling asset. The adapted formulas for assessing emissions from each asset **in operation** will depend on whether the amount of the charge during the reporting period is known. The amounts should be covering the respective reporting year.

If the charge amount is known, then the following formula will be applied:

Emissions in carbon dioxide equivalents =
Grams of refrigerant charged * refrigerant specific GWP

In most of the cases the charge amounts may not be known unless the servicing companies provide this information. Therefore, in cases when charge amounts cannot be obtained, the following formula will be applied:

Emissions in carbon dioxide equivalents =
(Total refrigerant charge amount[10] * leakage rate of asset category) * refrigerant specific GWP

[9] GWP values from the latest (Sixth) IPCC Assessment Report.
[10] Refers to the initial nominal charge of a refrigerant in an asset when it has been procured.

At the end of life of a cooling asset (disposal), a certain one-time emission occurs. The rate of that emission will depend on the recycling center's ability to recover the refrigerant. The emissions at the **disposal** of an asset can be estimated as follows:

Emissions in carbon dioxide equivalents = (Remaining refrigerant charge – amount of refrigerant recycled or destroyed) * refrigerant specific GWP

In case the remaining refrigerant charge in the asset is unknown, the total charge amount of the cooling asset will be used. See Annex I, table 5 for total charge amounts of most typical cooling assets.

When the value of refrigerant emissions in CO_2e is determined for all individual cooling assets and vehicles, total refrigerants can be calculated by summarizing the numbers from each individual cooling asset.

Process for calculating direct emissions from cooling assets

This section describes the steps to apply the methodology described above to assess CO_2e emissions from cooling assets.

Step 1: Identification of cooling assets and the charges

Each UNDP office establishes a list of the cooling assets which use refrigerants (refrigerators, air conditioning systems and vehicles). Once established, offices review information on this list once a year, during the EMT reporting exercise, and update as necessary.

For each cooling asset, an office needs to obtain information on the type of refrigerant used and the total charge amount (i.e., how much refrigerant is in the cooling system of the asset when initially charged). This information can typically be found on a sticker or plaque on the asset and under the hood of a vehicle.

Table 2 below represents a good example of the type of information required at this step. It is based on the compilation of the information submitted by UNDP offices during a pilot of this methodology and captures all asset categories identified by the piloting offices.

Table 2: Example of type of information required when identifying cooling assets and charges.

Asset Category	**Location**	**Refriger ant type**	**Refrigerant charge in grams**	**Year Purchased**	**Operation Status**
Domestic refrigeration	On 8th floor	R134a	120	2003	In operation
Stand-alone commercial applications	1,2,3 floor Hall, water dispenser	R410A	350		In operation
Medium & large commercial refrigeration	118	R404A	400	2018	In operation
Chillers	Module II MITSUBISHI	R410A	43,000	2015	In operation
Residential and commercial A/C	102	R410A	1,850	2018	In operation
Mobile A/C, regular vehicles	Country Office Car	R134a	550	2014	In operation

When an office is unable to locate and provide the refrigerant and/or the charge amount, these values are approximated and recorded in the EMT based on credible and conservative assumptions. It is important to note that actual data will generally result in lower carbon footprints than when assumptions are applied. Please refer to "Step 4: Calculations" and Annex I, table 5 for an overview of commonly used refrigerants and charge amounts used for assumptions.

Step 2: Obtaining and recording leakage rates during operation

Every cooling asset has a different leakage rate. The leakage rate depends on the cooling asset category (e.g., a refrigerator or an air conditioner), maintenance practices, conditions of use etc. Some assets, such as chillers and vehicles, can be expected to be regularly serviced and refrigerants be recharged during their lifetime. Other assets, such as refrigerators and window AC units, are typically not refilled during their use.

Under this step, offices are requested to contact their servicing companies and/or premises owners and provide data on the actual amounts of refrigerants used to top off the charges / refill assets during the year. While this is the most accurate method[11] of assessing refrigerant emissions, it is known to be a challenging exercise in certain contexts due to lack of time, resources, or availability of information from service companies. Nonetheless, the EMT will maintain this option for providing data so that offices can increase the accuracy of their reporting over time. It is recommended for offices to include reporting responsibilities into contracts with servicing companies so that data can be more easily be obtained in the future.

In the absence of actual data on the amount of refilled or topped off refrigerants in assets, the EMT uses emission factors recommended by the IPCC[12] to estimate leakage rates. Based on the asset category, the highest default emission factors for RAC systems will be used.[13] Assuming highest emission factors follows the principle of conservative reporting and at the same time incentivizes the offices to seek data on actual leakage rates[14]. In case default emission factors are available for a specific country, those should be used to increase accuracy of results.

Step 3: Obtaining and recording emissions from disposal

A similar approach is used for estimating the emissions from cooling assets which have been disposed of during the reporting year. If available or possible, offices are asked to provide data on the amount of refrigerant remaining in the asset at the time of disposal and how much of that amount has been recycled or destroyed by a certified RAC servicing company. Offices may be able to get that information from a company which undertook disposal of the asset.

In most of the cases and at least in the beginning, it will likely be challenging for offices to obtain and submit this information. In such cases, as in the case of annual leakages during the operation, the EMT will use the highest default emission factors recommended by the IPCC for end-of-life disposal. In practice, it will be assumed that all the remaining charge will be emitted at disposal.

If assets are landfilled without proper recovery of the refrigerant, it will leak over years or decades. However, since it is impossible to estimate the amount of this leakage per year, the full amount of refrigerants remaining at the disposal of the asset is attributed as emissions during the reporting year where the asset

[11] Referred to as a 'simplified mass balance method'

[12] "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories" at https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/3_Volume3/19R_V3_Ch07_ODS_Substitutes.pdf

[13] From Table 7.9 of "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories".

[14] The assumption being that the actual leakage rates are lower than those based on highest default emission factors.

was disposed of. Therefore, if the asset is disposed of during the reporting year without data on the recovered amount of refrigerant, recorded GHG emission data might show a spike. Where assets are sold or otherwise transferred to third parties, leakage during disposal is not taken into consideration.

In addition, the EMT provides a section where offices are required to report on how the asset was disposed of, contributing to the monitoring of UNDP's waste footprint and waste management practices.

Step 4: Calculations

Based on the data from steps 1, 2, and 3 above, the EMT uses the following formulas to calculate annual emissions for each cooling asset in operation during the respective reporting year.

I. Assets in operation

The formulas for assessing emissions from each asset in operation will depend on whether the amount of the charge during the reporting period is known. The amounts should be covering the entire reporting year.

If the charge amount is known, then the following formula will be applied:

Emissions in carbon dioxide equivalents = **Grams of refrigerant charged * refrigerant specific GWP**

In most of the cases the charge amounts may not be known unless the servicing companies provided this information. Therefore, in cases when charge amounts cannot be obtained, the following formula will be applied:

Emissions in carbon dioxide equivalents = **(Total refrigerant charge amount[15] * leakage rate of asset category) * refrigerant specific GWP**

Step 1 yields the data for refrigerants and charges and step 2 yields data on leakage rates to be used in the above formulas. For the remaining input to calculate the CO_2 emissions, the EMT applies the GWP values for 100 years horizon for refrigerants from the Sixth IPCC Assessment Report[16]. In cases when a refrigerant is newly synthesized, the most up-to-date estimated GWP value will be used until the official IPCC values is available. Table 3 in Annex I contains information on GWPs of most commonly used refrigerants.

II. Disposed assets

Direct emissions from refrigerants in cooling assets which are disposed are calculated using the following formula:

Emissions in carbon dioxide equivalents = **(Remaining refrigerant charge – amount of refrigerant recycled or destroyed) * refrigerant specific GWP**

In case the remaining refrigerant charge in the asset is unknown, amounts for most typical cooling assets used for assumptions can be found in Annex I, table 5.

[15] Refers to the initial nominal charge of a refrigerant in an asset when it has been procured.
[16] Table 7.SM.7 at https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_07_Supplementary_Material.pdf

Analysis

Based on the above information provided by UNDP offices, UNDP will analyze the following indicators to monitor progress on refrigerants management:

- Annual trends in quantity of direct emissions from refrigerants in carbon dioxide equivalents and their breakdown by region, countries and offices.
- Trends of the use of refrigerants in the following groups: chlorofluorocarbon (CFCs), hydrochlorofluorocarbon (HCFCs), hydrofluorocarbons (HFCs)[17], and others along with aggregated ozone depleting potential (ODP) and CO2-equivalent values.
- Trends of the use of natural vs. synthetic refrigerants.
- Trends in the use of refrigerants controlled under the Montreal Protocol.
- Trends in actual data provided vs. reverting to IPCC default factors. This ratio should decline over the years indicating that UNDP Offices are more aware of actual leakages and emissions and build data reporting responsibilities into contracts with service providers and landlords.

The Moonshot Team and MPU will undertake a sensitivity analysis of the results on a regular basis. The analysis will include checking the assumptions and comparing the results with similar estimates of emissions from facilities by other organizations. All UNDP offices can track their progress towards reducing the carbon footprint of refrigerants use via the EMT.

For questions, please send an email to the UNDP Greening Moonshot team at greening@undp.org.

[17] Controlled under the Kigali Amendment of the Montreal Protocol with the phase down schedule.

References

1. The UN Secretary-General António Guterres' message for the International Day for the Preservation of the Ozone Layer on 16 September 2021
https://www.un.org/press/en/2021/sgsm20901.doc.htm

2. International Energy Agency (IEA), 2018. The Future of Cooling
https://www.iea.org/fuels-and-technologies/cooling?utm_content=bufferbb0bd&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

3. The Economist Intelligence Unit (EIU), 2019. The Cooling Imperative: Forecasting the size and source of future cooling demand
http://www.eiu.com/graphics/marketing/pdf/TheCoolingImperative2019.pdf

4. Yabin Dong, Marney Coleman, and Shelie A. Miller. "Greenhouse Gas Emissions from Air Conditioning and Refrigeration Service Expansion in Developing Countries" in Annual Review of Environment and Resources, Vol. 46:59-83, October 2021
https://www.annualreviews.org/doi/full/10.1146/annurev-environ-012220-034103#abstractSection

5. Intergovernmental Panel on Climate Change (IPCC). 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/

6. Intergovernmental Panel on Climate Change (IPCC), 2021. Sixth Assessment Report
https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_07_Supplementary_Material.pdf

7. The World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), 2005. Calculating HFC and PFC Emissions from the Manufacturing, Installation, Operation and Disposal of Refrigeration & Air Conditioning Equipment
https://ghgprotocol.org/sites/default/files/hfc-cfc_0.pdf

8. United States Environmental Protection Agency (US EPA), 2014. Greenhouse Gas Inventory Guidance: Direct Fugitive Emissions from Refrigeration, Air Conditioning, Fire Suppression, and Industrial Gases
https://www.epa.gov/sites/default/files/2015-07/documents/fugitiveemissions.pdf

9. United Nations Environment Programme, OzonAction. Refrigerant Blends: Calculating Global Warming Potentials
https://www.unep.org/ozonaction/resources/factsheet/refrigerant-blends-calculating-global-warming-potentials

Annex I: Supplemental information

Overview of most commonly used refrigerants

Table 3: Detailed overview of most commonly used refrigerants

Refrigerants	**Type**	**GWP (100yrs)**	**Ozone Depletion Potential (ODP)**	**Controlled under the Montreal Protocol**	**Controlled under UNFCCC**	**Natural/ Synthetic**
R12	CFC	11,200	1	Yes	No	Synthetic
R22	HCFC	1,960	0.055	Yes	No	Synthetic
R134a	HFC	1,530	0	Yes	Yes	Synthetic
R404a	HFC	4,728	0	Yes	Yes	Synthetic
R407C	HFC	1,908	0	Yes	Yes	Synthetic
R410A	HFC	2,256	0	Yes	Yes	Synthetic
R32	HFC	771	0	Yes	Yes	Synthetic
R600a	HC	0	0	No	No	Natural
R290	HC	0	0	No	No	Natural
R717	Ammonia	0	0	No	No	Natural
R744	CO_2	1	0	No	No	Natural
1234yf	HFO	1	0	No	No	Synthetic
R454B	HFO	532	0	No	No	Synthetic

GWP calculations for refrigerant blends[18]

IPCC contains the GWP values of single-component refrigerants (i.e., containing only one kind of molecule in the gas) and therefore the GWP of each sub-component is used to calculate the final GWP of the refrigerant blend. If the refrigerant is listed by IPCC, the GWP is taken from the Sixth IPCC Assessment Report. If the refrigerant is not listed, the GWP is calculated based on the GWP for each component in the refrigerant using the following formula.

GWP = %Refrigerant1 * GWPRefrigerant1 + %Refrigerant2 * GWP Refrigerant2 + %Refrigerant3 * GWP Refrigerant3[19]

Example:

R404A

Subcomponent	**Percentage (ARI-700)**	**GWP 100yrs (IPCC)**
R-125	44%	3740
R-143a	52%	5810
R-134a	4%	1530

GWP 100yrs (R404A) = 44%*3740 + 52%*5810 + 4%*1530 = **4,728**

[18] Refrigerant blends are not covered by this methodology as they are currently not commonly used refrigerants in UNDP assets
[19] https://www.unep.org/ozonaction/resources/factsheet/refrigerant-blends-calculating-global-warming-potentials

Emission rates per asset category

Table 4: Overview of emission rates per asset category

Asset categories	**Service leak rate (yearly)**	**Disposal leak rates (one time at year of disposal)**
Domestic refrigeration	0.5%	100%
Stand-alone commercial applications	15%	100%
Medium & large commercial refrigeration	35%	100%
Transport refrigeration	50%	100%
Industrial refrigeration	25%	100%
Chillers	15%	100%
Residential and commercial A/C	10%	100%
Mobile A/C, buses	20%	100%
Mobile A/C, regular vehicles	20%	100%

For the purpose of this methodology, the highest leakage rates were adopted based on the ranges provided in the '2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories'.

Assumptions

The below table provides assumptions where relevant data cannot be obtained (i.e. if a sticker or name plate of an asset is damaged or cannot be found). These values are based on the expert opinion of the consultant; the estimated charge amounts for most typical cooling assets are in the highest range and conservative assumptions are made for the refrigerant type.

Table 5: Overview of commonly used refrigerants and charge amounts for most typical cooling assets

Type/sub-type of cooling asset	***Refrigerant***	***Amount [grams]***
Domestic refrigeration		
Small Fridges <300 l	R134a	80
Medium Size Fridges 300-400 l	R134a	100
Large size fridges >400 l	R134a	120
Stand-alone commercial applications		
Small	R404a	150
Medium	R404a	250
Large	R404a	400
Medium & large commercial refrigeration		
Medium	R404a	2000
Large	R404a	5000
Transport refrigeration	N/A	N/A
Industrial refrigeration	N/A	N/A
Chillers	N/A	N/A
Residential and commercial A/C		
<12000 BTU/H	R410a	800
12000-36000 BTU/H	R410a	1800
>36000 BTU/H	R410a	5000
Mobile A/C, buses		

Type/sub-type of cooling asset	***Refrigerant***	***Amount [grams]***
Small size	R134a	2500
Full size	R134a	6000
Mobile A/C, regular vehicles		
Regular passenger	R134a	800
SUV's	R134a	1500

Asset categories

The table below provides details on assets types included under each asset category included in this methodology.

Table 6: Type of assets under asset categories

Asset category	***Type of assets***
Chillers	Larger chillers often placed outside the building (roof top or beside), used for A/C and other central cooling needs. Common in large buildings like HQ.
Domestic refrigeration	Regular household refrigerators (1-2 door fridges), often used in smaller kitchens for office use.
Medium/Large Commercial refrigeration	Cold storage rooms, for restaurants and other applications, may not be very common at UNDP offices, except for medical supplies storage or larger cantinas.
Mobile A/C, buses	Minibuses up to 15+ passengers.
	Full size buses.
Mobile A/C, regular vehicles	Regular vehicles and larger 7-seater SUV’s.
Residential and commercial A/C	This area covers various appliances, most common are:
	Wall mounted A/C’s (window types), old technology.
	Mini split systems (an outdoor condensing unit and an indoor mounted fan coil, one room use), very common.
	VRF (Variable Refrigerant Flow) systems, these are units similar to mini split units, but are able to serve several rooms in the building, common.
Stand-alone commercial applications	Smaller display unit (e.g., a Coca Cola/Pepsi glass door refrigerator) or e.g., a vending machine where employees can purchase cold products. Smaller ice cube machines and water coolers should be included here as well.
Transport refrigeration	Transport Refrigerated Units (TRUs) incl. truck vans, semi-truck trailers, shipping containers, and railcars.
Industrial refrigeration	Food processing
	Large cold storage (for smaller cold storage rooms see "Medium/Large Commercial Refrigeration".