UNITED NATIONS

EP

United Nations Environment Programme

Distr.
GENERAL

UNEP/OzL.Pro/ExCom/98/28
1 June 2026

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Ninety-eighth Meeting
Montreal, 22–26 June 2026
Item 8(d) of the provisional agenda[1]

PROJECT PROPOSAL: BRAZIL

This document consists of the comments and recommendation of the Secretariat on the following project proposal:

Phase-down

• Kigali HFC implementation plan (stage I, first tranche)	UNDP, UNIDO and the United Kingdom	Individual consideration

[1] UNEP/OzL.Pro/ExCom/98/1

PROJECT EVALUATION SHEET – MULTI-YEAR PROJECTS

Brazil

PROJECT TITLE	AGENCY
Kigali HFC implementation plan (stage I)	UNDP (lead), UNIDO and the UK

ARTICLE 7 DATA (Annex F)	Year: 2024	27,247.32 mt	43,693,160 CO_2-eq tonnes

COUNTRY PROGRAMME SECTORAL DATA (CO_2-eq tonnes) AND ACTIVITIES								Year:	2025
	Aerosol	Foam	Fire-fighting	Air-conditioning (AC) and refrigeration				Solvent	Other*
				Manufacturing			Servicing		
				Refrigeration	AC	Other			
HFCs	178,135	8,240	271,795	5,548,214	9,700,538	6,155,297	34,256,435	1,164	7,994,766
Planned activities agreed				Yes	No		Yes		

* Includes local blending and other uses in the refrigeration and AC sectors

AVERAGE 2020–2022 HFC CONSUMPTION IN SERVICING	13,224.14 mt	27,003,909 CO_2-eq tonnes

BASELINE DATA (CO_2-eq tonnes)	2020	2021	2022	Average 2020–2022
HFC annual consumption	36,869,443	44,068,386	79,416,087	53,451,305
HCFC baseline (65%)				19,446,375
HFC baseline				72,897,680

HFC CONSUMPTION ELIGIBLE FOR FUNDING (CO_2-eq tonnes)	
Starting point for sustained aggregate reductions	TBD
Previously approved HFC phase-down investment projects	No
Aggregate reductions from previously approved projects	n/a

PROJECT DATA AS AGREED			2026*	2027	2028	2029	2030	2031	2032	Total
Consumption (CO_2-eq tonnes)	Montreal Protocol limits		72,897,680			65,607,912			65,607,912	n/a
	Maximum allowable		72,897,680			65,607,912			64,149,958	n/a
	Reduction from baseline (%)		0.0			10.0			12.0	n/a
Project costs requested in principle (US $)	UNDP	Project costs	6,088,040	0	7,864,178	0	6,285,766	0	0	20,237,984
		Support costs	426,163	0	550,492	0	440,004	0	0	1,416,659
	UNIDO	Project costs	1,566,337	0	1,236,622	0	1,049,925	0	0	3,852,884
		Support costs	109,644	0	86,563	0	73,495	0	0	269,702
	UK	Project costs	1,080,607	0	1,080,607	0	240,137	0	0	2,401,351
		Support costs	123,367	0	123,367	0	27,415	0	0	274,149
Total amounts recommended in principle (US $)		Project costs	8,734,984	0	10,181,407	0	7,575,828	0	0	26,492,219
		Support costs	659,174	0	760,422	0	540,914	0	0	1,960,510
		Total funds	9,394,158	0	10,941,829	0	8,116,742	0	0	28,452,729

* Recommended for approval at the present meeting

Reduction from remaining consumption eligible for funding in stage I (CO_2-eq tonnes)	7,289,768

Secretariat's recommendation	Individual consideration

PROJECT DESCRIPTION

1. The present document contains the following sections:

I. Summary of the proposal as submitted

II. Background: Status of implementation of the HCFC phase-out management plan and previous HFC-related activities

III. HFC consumption overview: HFC consumption levels, trends, and consumption by sector

IV. Stage I of the Kigali HFC implementation plan, as submitted: Regulatory framework, phase-down strategy, total stage cost, and implementation plan for the first tranche

V. Secretariat's comments, including the agreed cost of activities

VI. Recommendation

I. Summary of the proposal as submitted

2. On behalf of the Government of Brazil, UNDP as the lead implementing agency has submitted a request for stage I of the Kigali HFC implementation plan (KIP) at a total cost of US $28,452,729, consisting of US $20,087,428, plus agency support costs of US $1,406,120, for UNDP, US $4,003,440, plus agency support costs of US $280,241, for UNIDO and US $2,401,351, plus agency support costs of US $274,149, for the Government of the United Kingdom of Great Britain and Northern Ireland,[2] as originally submitted.[3]

3. The implementation of stage I of the KIP will assist the Government of Brazil in meeting the target of 10 per cent reduction from its HFC baseline consumption by 1 January 2029 and in maintaining it until 2032.

4. The first tranche of stage I of the KIP being requested at this meeting amounts to US $7,918,826, consisting of US $5,474,694, plus agency support costs of US $383,229, for UNDP, US $800,869, plus agency support costs of US $56,061, for UNIDO and US $1,080,607, plus agency support costs of US $123,367, for the Government of the United Kingdom of Great Britain and Northern Ireland, as originally submitted, for the period of July 2026 to June 2028.

II. Background

Status of implementation of the HCFC phase-out management plan

5. Table 1 presents the information on the status of implementation of Brazil's HCFC phase-out management plan (HPMP) as of February 2026.

Table 1. HPMP status for Brazil

Particulars	Stage I	Stage II	Stage III
Meetings when HPMP was approved or updated	64th/75th	75th/80th/82nd/86th/88th/ 91st/94th	94th

[2] The submitted proposal initially included two bilateral agencies for one project component, with the Government of the United Kingdom as the implementing agency for two tranches and the Government of Germany as the implementing agency for the third tranche. This arrangement was subsequently revised so that all three tranches are implemented by the Government of the United Kingdom.

[3] As per the letter of 20 February 2026 from the Ministry of Environment and Climate Change of Brazil to UNDP.

Particulars	Stage I	Stage II	Stage III
Reduction from baseline	10% by 2015	45% by 2021	100% by 2030
Total stage cost (US $)	19,417,866	26,019,401	33,816,456
Date of completion (actual or planned)	1 December 2019	31 December 2025	31 December 2031

Status of implementation of previous HFC-related activities

6. Brazil has not implemented any HFC-related activities funded by the Multilateral Fund in the context of the Kigali Amendment.

III. HFC consumption overview

HFC consumption levels

7. Brazil does not produce HFCs and only imports them for use in the refrigeration and air-conditioning (RAC) manufacturing, RAC servicing, aerosol, firefighting, foam and solvent sectors. The most consumed substances in 2025 were HFC-134a (36.8 per cent of total HFC consumption in CO_2-equivalent (CO_2-eq) tonnes or 42.9 per cent in metric tonnes (mt)), R-410A (18.6/14.9 per cent), R-404A (18.4/7.8 per cent)), HFC-32 (10.6/26.1 per cent), HFC-125 (10.4/5.0 per cent), and other HFCs (5.3/3.4 per cent). Table 2 presents the country's HFC consumption in 2020–2025 as reported to the Ozone Secretariat under Article 7 of the Montreal Protocol, and the country's HFC baseline.

Table 2. 2020–2025 HFC consumption and baseline for Brazil (Article 7 data)

HFC	GWP	2020	2021	2022	2023	2024	2025*
Metric tonnes (mt)							
HFC-32	675	1,776.02	2,869.60	4,144.23	2,738.46	7,540.55	8,892.15
HFC-125	3,500	1,556.70	2,855.58	4,213.88	1,015.44	636.52	1,688.38
HFC-134a	1,430	8,909.98	9,084.27	15,538.92	10,101.56	11,765.20	14,643.98
HFC-143a	4,470	54.00	18.00	614.40	0	0	234.01
HFC-152a	124	0	0	29.15	30.20	56.52	28.02
HFC-227ea	3,220	0.08	1.00	46.53	66.56	20.32	56.05
HFC-236fa	9,810	0	0	2.39	2.46	4.24	3.86
HFC-245fa	1,030	23.18	10.89	22.04	12.84	8.00	8.00
R-404A	3,921.6	2,253.83	2,425.44	5,606.01	1,222.04	2,370.05	2,663.98
R-407C	1,773.85	307.11	313.29	515.58	439.33	435.66	369.91
R-410A	2,087.5	3,393.63	3,775.38	5,883.70	3,661.28	4,175.39	5,071.85
R-507A	3,985	43.58	65.71	187.65	5.10	111.64	78.14
CustMix-134**	963.82	441.60	729.60	534.28	268.32	0	-4.32
Other***		71.85	69.55	136.75	238.40	123.23	373.11
Total (mt)		**18,831.56**	**22,218.31**	**37,475.51**	**19,801.99**	**27,247.32**	**34,107.12**
CO_2-eq tonnes							
HFC-32	675	1,198,812	1,936,980	2,797,355	1,848,461	5,089,871	6,002,201
HFC-125	3,500	5,448,450	9,994,530	14,748,580	3,554,040	2,227,820	5,909,330
HFC-134a	1,430	12,741,271	12,990,506	22,220,656	14,445,231	16,824,235	20,940,891
HFC-143a	4,470	241,380	80,460	2,746,368	0	0	1,046,025
HFC-152a	124	0	0	3,615	3,745	7,008	3,474
HFC-227ea	3,220	258	3,220	149,827	214,323	65,430	180,481
HFC-236fa	9,810	0	0	23,446	24,133	41,594	37,867
HFC-245fa	1,030	23,875	11,217	22,701	13,225	8,240	8,240

HFC	GWP	2020	2021	2022	2023	2024	2025*
R-404A	3,921.6	8,838,620	9,511,613	21,984,529	4,792,352	9,294,388	10,447,064
R-407C	1,773.85	544,767	555,729	914,562	779,306	772,796	656,165
R-410A	2,087.5	7,084,203	7,881,112	12,282,224	7,642,922	8,716,127	10,587,487
R-507A	3,985	173,666	261,854	747,785	20,324	444,885	311,388
CustMix-134**	963.82	425,623	703,203	514,950	258,612	0	-4,164
Other***		148,517	137,961	259,490	478,383	200,765	764,545
Total (CO_2-eq tonnes)		**36,869,443**	**44,068,386**	**79,416,087**	**34,075,056**	**43,693,160**	**56,890,995**

HFC baseline calculation (CO_2-eq tonnes)	
Average HFC consumption in 2020–2022	53,451,305
HCFC baseline (65%)	19,446,375
HFC baseline	72,897,680

* CP data (imports minus exports)

** HFC-365mfc (93 per cent) and HFC-227ea (7 per cent)

*** Including HFC-23, HFC-365mfc, HFC-43-10mee, R-407A, R-407F, R-417A, R-422A, R-422D, R-437A, R-438A, R-444B, R-448A, R-449A, R-449C, R-452A, R-453A, R-454A, R-454B, R-454C, R-455A, R-470A, R-470B, R-471A, R-508B, R-513A, R-514A, R-515B, and custom mixes 335, 336, 337, 338, 345, 369, 381, 386 and 403.

Country programme implementation report

8. The sectoral HFC consumption data provided by the Government of Brazil in its country programme (CP) implementation report for 2024 is consistent with the data reported under Article 7 of the Montreal Protocol.

HFC consumption trends

9. HFC consumption fluctuated over the past six years; after reaching 65,627,001 CO_2-eq tonnes in 2019, it dropped sharply in 2020 to 36,869,443 CO_2-eq tonnes and remained relatively low in 2021 at 44,068,386 CO_2-eq tonnes, largely due to the economic effects of the COVID-19 pandemic. In 2022, consumption rose again to 79,416,087 CO_2-eq tonnes, reflecting both market recovery and efforts by importers to restore HFC supply to actual national demand levels. The subsequent decline in 2023 was partly explained by the fact that much of the equipment servicing postponed during 2020 and 2021 had already been carried out in 2022. HFC consumption then resumed an upward trend in 2024 and 2025.

10. At the individual substance level, HFC-32 increased from 9.4 per cent of total consumption, measured in metric tonnes, in 2020 to 26.1 per cent in 2025, partly due to room air-conditioning (AC) manufacturing enterprises converting from R-410A to HFC-32. While most remaining substances follow a trend similar to the overall HFC consumption trend, consumption levels of HFC-134a and R-410A (the two most widely used HFCs in the country) were, in 2025, close to the 2022 levels.

HFC consumption by sector

11. In the manufacturing sectors, in 2024, HFCs were consumed mainly for residential AC (18 per cent in mt and 16 per cent in CO_2-eq tonnes), followed by mobile air-conditioning (MAC) (6/5 per cent), commercial refrigeration (3/3 per cent), and other subsectors. Consumption patterns were similar in the servicing sectors, with HFCs mainly consumed for MAC (17 per cent in mt and 14 per cent in CO_2-eq tonnes), residential AC (13/14 per cent), commercial refrigeration (7/12 per cent), and other subsectors, as shown in table 3. A detailed table with HFC consumption per substance and sector based on the survey is provided in annex I to the present document.

Table 3. Estimated sectoral distribution of HFC use in Brazil (survey)*

Sector	Use				Most commonly consumed HFCs
	mt	Share (%)	CO_2-eq tonnes	Share (%)	
Manufacturing					
Domestic refrigeration	59.30	0.2	84,804	0.2	HFC-134a
Commercial refrigeration	788.67	2.9	1,653,792	3.4	HFC-134a, R-404A
Industrial refrigeration	363.40	1.3	995,953	2.1	HFC-134a, R-404A, R-410A
Transport refrigeration	188.70	0.7	598,966	1.2	HFC-134a, R-404A,
Room AC	4,787.00	17.6	7,782,300	16.2	HFC-32, R-410A
MAC	1,566.17	5.7	2,239,629	4.7	HFC-134a
Commercial AC	762.07	2.8	1,382,763	2.9	R-410A, HFC-32, HFC-134a
Other RAC**	3,945.52	14.5	4,069,812	8.5	HFC-134a, R-410A, others
Aerosols	450.00	1.7	643,506	1.3	HFC-134a
Firefighting	49.76	0.2	193,850	0.4	HFC-125, HFC-227ea, HFC-236fa
Foam, solvent and others	65.78	0.2	17,416	0.0	HFC-245fa, HFC-43-10mee
Subtotal manufacturing	**13,026.38**	47.8	**19,662,792**	41.0	
Servicing	**14,220.95**	52.2	**28,309,310**	59.0	HFC-32, HFC-134a, R-404A, R-407C, R-410A, R-507A, others
Total (all sectors)	**27,247.33**	100.0	**47,972,102**	100.0	

*Best estimates. Differences with reported consumption may be partially associated with the accounting of local blending
**Not identified uses in RAC, possibly including room AC, the local installation and assembly subsector and local blends

Manufacturing sectors

Domestic refrigeration manufacturing

12. The domestic refrigeration market is dominated by local production, with high household penetration (98 per cent refrigerators and 17 per cent freezers), about 105 million units in use and annual production of 6.2 million units. Around 95 per cent of new locally manufactured units are charged with isobutane (R-600a), and 5 per cent with HFC-134a. There are 20 major manufacturers supplying 26 brands and roughly 400 models, all compliant with the Brazilian Labelling Programme, which has regulated energy efficiency since 2007. The current installed base of HFC-134a is about 6,615 mt and the estimated 2024 HFC consumption in manufacturing was 59.3 mt.

Light commercial refrigeration manufacturing

13. Brazil's light commercial refrigeration sector, including hospitality, retail, and related services, has an installed HFC base of about 1,086 mt. In 2024, manufacturing used an estimated 380 mt of HFCs, mainly HFC-134a (304 mt) and R-404A (76 mt), with some of the 116 manufacturers also active in commercial refrigeration. The sector produces a wide range of equipment, including beverage display cases, upright and chest freezers, ice makers, beer dispensers, ice cream dispensers, refrigerated counters, ice cream display cases, water coolers (filtered water dispenser), remote refrigerated counters, cold rooms, and walk-in coolers and freezers.

14. Common refrigerants include HCFC-22 (older systems), HFC-134a (beverage and ice cream display cases, beer and ice cream dispensers, ice makers, refrigerated counters, cold rooms and walk-in coolers and freezers), propane (R-290) (beverage display cases, upright and chest freezers, beer dispensers and water coolers), R-404A (upright and chest freezers, ice makers, ice cream dispensers, refrigerated counters, ice cream display cases, cold rooms and walk-in coolers and freezers) and R-600a (upright and chest freezers and water coolers).

Commercial refrigeration manufacturing

15. The commercial refrigeration sector includes food retailers such as supermarkets, grocery stores, bakeries and butcher shops, with supermarkets being the most comprehensive, often using large-scale storage and processing facilities, some classified as industrial refrigeration. Equipment includes plug-in and remote display cases, cold rooms, processing and storage facilities, condensing units, compressor racks, chillers, and full refrigeration systems. The sector has an estimated installed HFC base of 3,238 mt. Twenty-two manufacturers have been identified to date; however, a more detailed survey is needed to determine the entire population of enterprises in this subsector. While HCFC-22 was dominant before 2010, it has since been largely replaced by HFC-134a and R-404A, with growing use of alternatives such as R-290, R-454C, R-455A, R-448A, R-449A, and carbon dioxide (CO_2/R-744).

Industrial refrigeration manufacturing

16. The industrial refrigeration sector supports a wide range of industries through complex, high-capacity systems used for storage and large-scale processing. It partially overlaps with commercial refrigeration and requires specialized design, installation, and maintenance. The sector comprises over 268,000 installations requiring refrigeration and extensive infrastructure.[4] Equipment is predominantly medium- to large-scale, with high refrigerant charges, especially of ammonia (NH_3), and includes monoblock (plug-in) units, chillers, condensing units, refrigeration racks (flooded, direct, and indirect expansion), water/NH_3 absorption systems, centralized NH_3 plants, and packaged units. In recent years, the use of HFCs and newer alternatives, including HFO blends, CO_2, and hydrocarbons (HCs), has increased.

Transport refrigeration

17. Brazil's fleet of refrigerated cargo transport vehicles is estimated at 431,000 units, including cars and light commercial vehicles, urban cargo vehicles, medium- and heavy-duty trucks and semi-trailers. The main refrigerants used are R-404A for frozen products, HFC-134a for chilled products, and R-507A occasionally used in new equipment as an alternative. Since 2021, some imported equipment has used R-452A as a substitute for R-404A, although its price can be up to three times higher. Both international and domestic manufacturers continue to rely on HFC-134a and R-404A. In maritime refrigeration, HFC-134a remains dominant, while R-513A and HFO-1234yf are used to a lesser extent in newer containers. Estimated HFC consumption in 2024 was 188.7 mt (56.6 mt of HFC-134a and 132.1 mt of R-404A), with an installed base estimated at 1,397 mt.

Room air-conditioning

18. Room AC is Brazil's largest manufacturing sector consuming HFCs, accounting for 15 per cent of total consumption in both metric and CO_2-eq tonnes. Split AC systems dominate the market, with around 6 million units manufactured locally in 2024, including wall-mounted, floor-ceiling, cassette-type and ducted units used across residential and commercial settings. With capacity ranging from 9,000 to 70,000 BTU/h, they primarily use rotary hermetic compressors, with inverter technology now prevailing. Window units, with a recorded production of 420,000 units and imports of 325,000 units in 2024, mainly use R-410A, although HFC-32 imports are increasing. Portable units are fully imported, with 109,764 units registered in 2024, typically ranging from 10,000 to 14,000 BTU/h and using HFC-32 or R-410A.

19. Room AC equipment falls under the Brazilian Labelling Programme, with mandatory energy-efficiency labelling in place since 2006. There are at least four enterprises manufacturing window

[4] Industrial refrigeration end users include, among others, logistics warehouses, agribusinesses (seed storage, fruits, vegetables, and greens), beverage producers, food supply and distribution centres, slaughterhouses, dairy, fish, and seafood processing plants, large bakeries, oil and derivative plants, ice manufacturers, cosmetics and pharmaceutical producers, mining installations, rubber and derivative plants, sugar and ethanol mills, petrochemical, plastics, and chemical industries, and textile plants.

AC units, six manufacturing portable AC units and 18 manufacturing split and multi-split AC units. Between 2023 and 2026, manufacturing enterprises in this sector, including an estimated seven eligible ones, undertook a transition from R-410A to HFC-32, which is now expected to become the dominant refrigerant in new equipment. R-410A will remain in use where charge limitations prevent conversion (around 15 per cent of AC units in 2025) and will continue to be important for servicing existing systems.

Mobile air-conditioning

20. There are 26 manufacturers with 52 factories producing passenger vehicles, cargo vehicles, and agricultural and road machinery in the country, most of them multinationals with international or mixed (national and international) capital. In addition, three local enterprises manufacture MAC systems. HFC-134a is the main refrigerant used in MAC manufacturing in Brazil, with negligible use of HFO-1234yf also recorded. In 2024, around 2.5 million vehicles were locally manufactured, including 1.7 million passenger vehicles, 570,000 light commercial vehicles, and more than 214,000 trucks, buses, tractors and other heavy vehicles. Refrigerant demand for the manufacturing of MAC equipment during the production of vehicles and agricultural machinery in 2024 was estimated at 1,566 mt of HFC-134a, out of which 80 per cent (1,254 mt) was for passenger and light commercial vehicles.

Commercial and industrial air-conditioning and heat pumps

21. Commercial and industrial AC systems are mainly used in large, high-occupancy spaces such as offices, retail outlets, restaurants, hotels, and shopping centres, as well as in technical applications like data centres. They include variable refrigerant flow (VRF) systems using R-410A as well as rooftop and packaged systems with charges ranging from 8 to 162 tonnes of refrigeration (TR) supplied by seven manufacturers, also mainly charged with R-410A, and chilled-water plants used in industrial processes. Brazil's chiller market includes both international and domestic manufacturers, with equipment using HFC-134a and R-410A; options with low global-warming potential (GWP) remain limited. In 2024, around 329,000 TR in VRF systems, 219,000 TR in self-contained units, and 221,000 TR in chillers were commercialized. Estimated refrigerant demand for manufacturing was 459.7 mt of R-410A, 234.5 mt of HFC-134a, 22.7 mt of HFC-32, and 26.5 mt of other HFCs.

22. Brazil's heat pump manufacturing is limited, with main use for swimming pools and spas (50 to 70 per cent of demand) and water heating in the range of 27-70°C. The market is expanding into industrial and commercial applications for water heating and dehumidification processes. Most of the seven national manufacturers use R-410A in their production processes, with minor use of HCFC-22 also recorded; HFC-32, HFOs and HCs are considered as potential alternatives. The installed HFC load was about 800 mt in 2024, with annual manufacturing demand of 24 mt per year.

Other refrigeration and air-conditioning manufacturing and installation and assembly subsector

23. A portion of HFC consumption has been categorized as not identified uses. This likely includes consumption related to RAC manufacturing that has not been precisely specified, such as HFC-32 intended for room AC but not utilized due to slower-than-anticipated conversion from R-410A, as well as potential use within the local installation and assembly subsector.

Other manufacturing sectors

24. HFCs are used on a smaller scale in the following manufacturing sectors:

(a) *Aerosol and propellant:* A total of nine filling enterprises and 17 aerosol product manufacturers have been identified, with HFC-134a consumption of 450 mt. HFC-152a is used as a propellant in the glass manufacturing process to increase product transparency.

To date, there is no evidence of local manufacturing of metered-dose inhalers using HFCs, but further data is needed to confirm this;

(b) *Polyurethane (PU) and extruded polystyrene (XPS) foam:* Under the HPMP, Brazil converted more than 500 PU foam enterprises to low-GWP alternatives. In 2024, 8 mt of HFC-245fa were used in the PU foam sector and HCFC-22 continued to be used in XPS foam manufacturing by one ineligible enterprise. The use of HCFC-22 will be banned from 2030;

(c) *Solvents:* HFC-43-10mee is used as solvent (cleaning agents and in aerosols) in medical, electronic, aerospace, and industrial manufacturing applications. Further analysis is needed to determine if HFC-134a and R-513A are also being used in the country as solvents; and

(d) *Firefighting:* This sector uses mostly powder-based extinguishing agents, in addition to the use of nitrogen, CO_2 and water. Some firefighting equipment also uses HFCs, especially HFC-125, HFC-227ea and HFC-236fa.

Refrigeration and air-conditioning servicing sector

25. This sector accounts for approximately 52 per cent of HFC consumption in mt in Brazil, consuming mainly HFC-134a, R-410A, R-404A and HFC-32. There are approximately 218,650 AC installation and maintenance technicians and 46,327 refrigeration maintenance technicians in the country, about 38 per cent of them informal. Although women's participation in the sector is still low, training and inclusion initiatives are gradually increasing it, especially in the engineering, management, and supervisory roles. In technical courses, women represent 4 to 5 per cent of all students.

26. Specialized technical workforce is trained in technical and vocational courses offered by both private and public educational institutions. Some manufacturers, mainly in the room AC subsector, are also investing in on-site training centres which include new technologies based on lower-GWP refrigerants in their curricula. Many professionals, however, still enter the market without formal training, developing their competencies mainly through practical experience. The overall availability of skilled labor is still low, but more than 34,000 technicians have received training on key areas under the Brazilian HPMP, including the first pilot scheme for technicians' qualification, certification, and registration (QCR) at state level.

Domestic, light commercial, commercial, industrial and transport refrigeration servicing

27. Domestic refrigeration has an installed base of over 105 million units, with annual servicing demand of 445 mt of HFC-134a. Light commercial systems use a mix of HFC-134a and R-404A, with a servicing demand of about 380 mt; transition to HCs is gradually taking place. Commercial refrigeration has high leakage rates (around 45 per cent), requiring about 1,457 mt annually for servicing, with technicians servicing larger equipment often lacking adequate skills, despite the ongoing training activities.

28. Industrial systems have an estimated leakage rate of 35 per cent, with annual servicing demand of about 1,247 mt, supported by more advanced recovery, recycling, and reclaim practices, though long equipment lifespan slows down technology transition. In the refrigerated road transport, vibrations, pressure fluctuations, and maintenance practices result in leakage rates of 30 per cent, with annual HFC demand estimated at close to 368 mt, as systems are often fully recharged due to minor issues. In maritime transport, container (reefer) systems have leakage rates of about 25 per cent during operation, mainly due to maintenance practices and pre-trip testing, requiring around 29.8 mt of HFC-134a annually, while stationary reefers have higher leakage rates (about 35 per cent), adding approximately 17 mt to demand.

Residential and commercial air-conditioning and heat pumps servicing

29. Room AC servicing mainly involves refrigerant replacement during maintenance, as units are factory-charged. Leakage rates are estimated at about 9 per cent for split systems and 2 per cent for hermetic units (window and portable), with total servicing consumption of 3,442 mt, mostly of R-410A. Servicing is largely carried out by informal, self-taught technicians. For larger commercial and industrial AC, such as VRF systems, self-contained units, and chillers, refrigerant use occurs during both installation and maintenance. Servicing demand is estimated at 1,442 mt of mainly R-410A and HFC-134a. The estimated annual demand for servicing heat pumps is 300 mt of HFCs.

Mobile air-conditioning servicing

30. HFC-134a consumption in the MAC servicing sector, covering cars, light commercial vehicles, trucks, and agricultural machinery, is estimated at 4,694 mt. There is a shortage of adequate tools and practices, with a large portion of technicians lacking proper equipment for refrigerant recovery and recycling, leading to frequent venting of refrigerants during servicing and unnecessary full recharges.

31. In 2023, Brazil had about 112,373 enterprises offering a variety of car maintenance and repair services, but only around 20 per cent are estimated to perform MAC maintenance, including around 4,122 dealerships. The remaining ones are either accredited or authorized and independent workshops.

Local blending

32. At least two major local importers prepare HFC blends such as R-410A, R-404A, R-407 series, R-422D, and R-507A, mainly for the domestic AC market, with no plans to discontinue production. In 2024, around 4,000 mt of R-410A were blended locally.

IV. Stage I of the Kigali HFC implementation plan as submitted

Institutional, policy and regulatory framework

33. The National Secretariat of Climate Change, within the Ministry of Environment and Climate Change, coordinates the implementation of the Montreal Protocol through the Department of Policies for Adaptation and Resilience to Climate Change, specifically through the office of General Coordinator for Mitigation Policies and Ozone Layer Protection. The latter functions as the national ozone unit (NOU), and is tasked with implementing policies related to the Montreal Protocol, including the coordination of projects financed by the Multilateral Fund.

34. The Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) is the federal agency responsible for implementing environmental policies, including regulating the import, export, use, and disposal of substances under the Montreal Protocol. Its Montreal Protocol unit, within the Environmental Quality Directorate, oversees related regulations, coordinates federal actions, and manages the national registry of hazardous waste operators.

35. Brazil ratified the Kigali Amendment on 19 October 2022. IBAMA's Normative Instruction No. 29/2023 establishes the rules and procedures for controlling the importation of HFCs and blends containing HFCs in line with the Kigali Amendment. Current rules include the registration of importers, exporters, traders, and operators of refrigerant reclaim and incineration centers; control of imports through quotas and licensing; prohibition of intentional releasing of ozone-depleting substances (ODSs) into the atmosphere; and mandatory ODS recovery and proper final disposal at reclaim and/or incineration centres.

36. The agencies involved in the import and export operations are the Brazilian Federal Revenue Secretariat, the Ministry of Development, Industry and Foreign Trade and IBAMA, responsible for defining

and controlling quotas for controlled substances, setting conditions for import approvals, authorizing or denying imports, and inspecting the involved enterprises. IBAMA systematizes the data from the control and monitoring system and reports to the NOU. Exports of controlled substances require IBAMA's authorization and registration of the exporter. There are no quotas for exports.

37. The Ministry of Mines and Energy is responsible for implementing the National Energy Conservation Policy, including the establishment of minimum energy efficiency standards (MEPS) for all energy-consuming equipment produced or marketed in the country. The MEPS for domestic refrigeration and AC equipment are in place, with work ongoing since 2021 to expand them to commercial refrigeration. Industrial refrigeration is not yet covered due to its diverse and customized nature. In addition, the Brazilian Labelling Programme, coordinated by the National Institute of Metrology, Quality and Technology, is a public policy that promotes energy efficiency, transparency for the consumer, and industrial innovation.

Phase-down strategy for stage I of the Kigali HFC implementation plan

Overarching strategy

38. The Government of Brazil is proposing three stages for the KIP. Stage I is to be implemented until 2032, and stages II and III are expected to be implemented between 2031 and 2037, and between 2037 and 2046, respectively. Stage I of the KIP proposes to reduce HFC consumption by 10 per cent of the baseline by 2029 and sustain this reduction through 2032.

39. Brazil's KIP is part of the National Mitigation Strategy under the Industry Sector Plan and will support the forthcoming National Cooling Action Plan (PNAR, 2026) by reducing HFC use and improving RAC efficiency. In line with relevant Montreal Protocol decisions, Brazil intends to integrate energy efficiency into its HFC phase-down conversion projects.

Proposed reductions

40. UNDP included in the KIP request two business-as-usual (BAU) forecast scenarios, departing from an estimated consumption of 60,335,479 CO_2-eq tonnes in 2025, assuming average growth rates of 3 and 5 per cent, and adding 6 million CO_2-eq tonnes in 2027, corresponding to HFCs phased in as a result of HCFC phase-out.[5] The most conservative scenario, based on a 3 per cent growth rate, is presented in table 4.

Table 4. HFC consumption forecast under the unconstrained scenario, Montreal Protocol limits, and proposed HFC reductions under stage I of the KIP for Brazil (CO_2-eq tonnes)

	2026	2027	2028	2029	2030	2031	2032
HFC consumption forecast at an annual growth rate of 3 %*	62,145,543	70,009,910	72,110,207	74,273,513	76,501,719	78,796,770	81,160,673
Montreal Protocol HFC consumption limits	72,897,680	72,897,680	72,897,680	65,607,912	65,607,912	65,607,912	65,607,912
HFC consumption levels proposed under the KIP	72,897,680	72,897,680	72,897,680	65,607,912	65,607,912	65,607,912	65,607,912
Proposed reductions from the HFC consumption baseline (%)	0	0	0	10	10	10	10**

* Calculated based on a combination of factors, including economic growth, increase in the use of RAC equipment, and growing sales of heat ventilation and AC equipment. 6 million CO_2-eq tonnes are added in 2027, reflecting the need to use HFC drop-ins for HCFC-based equipment due to the 88.7 per cent reduction required by that year.
** As submitted

[5]HCFC-22 consumption in 2024 was 7,307.24 mt (13,226,104 CO_2-eq tonnes). The Brazilian regulation IN 20 of 2022 established a maximum HCFC-22 import limits of 6,650.7 mt for 2025 and 1,582.4 mt for 2027, leading to about 5,068 mt (9.2 million CO_2-eq tonnes) being reduced in that period. UNDP estimated that 6 million CO_2-eq tonnes of HFCs will be phased in from 2027 onwards to partly substitute for the expected sharp reductions in HCFC-22 use.

41. Based on the above forecast, the country would have difficulty complying with the 2029 consumption target. Under the second scenario provided by UNDP (annual growth of 5 per cent), the country would have difficulties complying with the 2027 consumption target.

42. The Secretariat notes that the 2025 consumption reported under the CP data report (56,890,994 CO_2-eq tonnes) was lower than UNDP's estimate (60,335,479 CO_2-eq tonnes). The Secretariat applied more conservative BAU scenarios, departing from the actual 2025 consumption, with annual growth at 3 and 5 per cent, and an increase of only 2 million CO_2-eq tonnes in 2027, resulting from the substitution of HCFCs by HFCs. Applying these assumptions, the country would still have difficulty complying with the 2029 consumption target in both cases.

Proposed activities

43. Stage I of the KIP for Brazil includes a regulatory component to establish the required framework to support HFC phase-down, investment projects in the industrial and light commercial refrigeration manufacturing sectors, and non-investment projects in refrigeration servicing, including technical assistance, training, and demonstration activities targeting the commercial refrigeration, industrial refrigeration and heat pumps, room AC, commercial AC, and MAC sectors, as originally submitted. A summary of proposed activities and requested funds is presented in table 5.

Table 5. Components and cost of stage I of the KIP, as submitted

Component details		Agency	Cost (US $)	
			Stage I	1st tranche
Investment projects				
Light commercial refrigeration manufacturing sector (conversion of 116 enterprises)		UNDP	7,425,000	2,500,000
Industrial refrigeration manufacturing sector (conversion of 3 enterprises)		UNIDO	865,601	755,869
Non-investment projects				
1	Regulatory actions	UNDP	510,000	250,000
2	Commercial refrigeration servicing sector	UNDP	1,999,002	193,000
3	MAC servicing sector activities	UNDP	6,001,196	1,735,196
4	AC servicing sector	UNDP	2,326,100	240,199
5	Industrial refrigeration and heat pump servicing sectors	UNIDO	2,773,890	0
6	Strengthening capacities of technicians and training centres, and pilot project for certification of technicians, focussing on commercial refrigeration and room AC servicing sector	UK	2,401,351	1,080,607
7	Project implementation and monitoring	UNDP	1,826,130	556,299
		UNIDO	363,949	45,000
Total			**26,492,219**	**7,356,170**
Subtotal for UNDP			**20,087,428**	**5,474,694**
Subtotal for UNIDO			**4,003,440**	**800,869**
Subtotal for the Government of UK			**2,401,351**	**1,080,607**

Manufacturing sectors

Light commercial refrigeration manufacturing sector (UNDP)

44. Stage I aims to achieve a complete phase-out of HFC consumption in the manufacturing of self-contained light commercial refrigeration equipment with charges up to 500 g of low-GWP refrigerant. This includes the conversion of 116 enterprises across the country to R-290, resulting in the phase-out of 300 mt of HFCs, revised to 307.77 mt during the review, including 267.77 mt (382,911 CO_2-eq tonnes) of HFC-134a and 40 mt (156,864 CO_2-eq tonnes) of R-404A, at a total cost of US $7,425,000.

45. Funding is requested for incremental capital costs (ICCs), including system and process redesign, prototyping and testing; refrigerant storage and distribution; assembly line modifications (including charging machines, vacuum pumps, ultrasonic welding and pressure testing equipment); plant fire safety (including safety systems, exhaust systems, leak detectors, refrigerant discharge system); inspection, commissioning and safety training; product and line certification; and trials and technical assistance. The type and volume of equipment proposed was determined in line with the type of enterprises. Incremental operating costs (IOCs) were requested at US $5.50/kg, as summarized in table 6.

Table 6. Conversion costs for the light commercial refrigeration manufacturing sector, as submitted

Activity / eligible equipment	Enterprises by HFC consumption			Total cost (US $)
	< 1.5 mt	1.5 mt – 15 mt	> 15 mt	
Number of enterprises (115*)	72	36	7	
Average consumption per enterprise kg	924	4,326	12,216	
Total per enterprise US $	91,102	154,692	411,818	
ICCs	86,020	130,900	344,630	13,318,250
IOCs	5,082	23,792	67,188	1,692,735
Total (US $)	6,559,344	5,568,899	2,882,743	**15,010,985**
Total funds requested in line with decision 95/86				**7,425,000**
HFC reduction (mt)				307.77
Cost-effectiveness (US $/kg)				24.13

*The initial submission included 66 small, 45 medium, and five large enterprises; this classification was adjusted during the review process based on consumption. In addition, one ineligible enterprise was removed reducing the total number to 115.

46. Throughout project implementation, enterprises will be encouraged to adopt energy-efficient solutions. UNDP included in its work programme the preparatory funding for a project under decision 94/60 to enhance the energy efficiency of R-290-based commercial refrigeration units manufactured by enterprises assisted by this project.

47. Upon completion of the project by the end of stage I, the Government of Brazil will introduce a ban on the manufacturing and import of self-contained commercial refrigeration equipment containing HFCs under a capacity to be determined through the implementation of the light commercial refrigeration project by 1 January 2033.

Industrial refrigeration manufacturing sector (UNIDO)

48. During stage I, UNIDO will assist three manufacturers of industrial refrigeration equipment in converting to low-GWP alternatives, for a total cost of US $865,601, as submitted:

(a) *Conela Indústria e Comércio de Refrigeração Ltda. (Conela):* Manufacturer of four types of industrial refrigeration equipment charged mainly with R-404A and R-410A (monoblocks, split systems (together accounting for about 90 per cent of production), parallel compression racks and chiller systems) for the storage of seeds and grains, pharmaceuticals, fresh produce, and medicine, with roughly 50 per cent of produced equipment fully charged at the factory, 40 per cent partially charged, and 10 per cent charged on-site. The project aims to convert Conela's production to R-290 and eliminate the use of 20.12 mt (57,274 CO_2-eq tonnes) of high-GWP HFCs;

(b) *Refrisat:* Manufacturer of industrial refrigeration equipment for sectors including plastics and rubber, medical applications and food, with annual HFC consumption of up to 9.96 mt of mainly R-410A and HFC-134a. The enterprise carries nine products using refrigerants: liquid chillers, oil coolers, medical/hospital chillers, chilled-water units, precision air conditioners, thermos chillers, air coolers, process and ambient air dehumidifiers, and compressed-air coolers. The project proposes to convert a production line of variable-speed

liquid chillers (below 100 kW) to R-290, phasing out 9.96 mt[6] of R-410A and 1.26 mt of HFC-134a (about 19,964 CO_2-eq tonnes in total); and

(c) *NTC Cooling:* Manufacturer of industrial refrigeration equipment with annual HFC consumption of up to 12.44 mt (mainly R-404A, R-410A, and HFC-134a), serving sectors such as agriculture, pharmaceuticals, distribution centres and process cooling. Production output includes direct and indirect expansion systems, notably parallel compressor racks (50–450 kW capacity for medium and 25–300 kW for low temperatures), partially assembled and charged at the factory and completed on-site. The project sets out to convert the medium-temperature rack house product line, with a capacity of up to 250 kW, currently based on R-404A, to operate with R-290 and CO_2 in medium and low temperatures, respectively, phasing out 10.87 mt of R-404A and 1.57 mt of R-410A (total of 45,905 CO_2-eq tonnes).

49. Funding is requested for the ICCs at each enterprise, including technical assistance for the development and safe handling of a selected equipment to operate with R-290, acquisition of equipment including a charging unit with transfer pump, leak detectors, explosion-proof industrial vacuum pump, disposal unit, and technical service equipment kit including recovery machine, portable ventilator and scale and safety devices (exhaust system and a connected monitoring control centre, fixed flammable refrigerant leak detectors, and additional measures including anti-static paint, grounding, and charging area adaptations); testing and pilot production. No IOCs are being requested.

50. The projects for Conela and NTC Cooling also include the demonstration of the installation and operation of R-290-based units at selected end-use facilities in the grain, seed or pharmaceutical conservation sector, and monitoring their performance for up to six months, with results to be published in an industrial journal and disseminated in two workshops. Table 7 presents the proposed costs of the three conversion projects as submitted.

Table 7. Cost breakdown of the industrial refrigeration conversion projects, as submitted (US $)

Activity	Conela	Refrisat	NTC Cooling
Development and safe handling of a selected line of equipment: • Conela: Monoblock plug-in units (from R-410 and R-404A to R-290), split systems (from R-410A and HFC-134a to R-290), parallel compression racks (from R-404A to R-290) and chiller systems (from R-410A to R-290) • Refrisat: Variable speed chillers (from R-410A to R-290) • NTC Cooling: Rack house (from R-404A to R-290 and CO_2)	69,296	39,621	24,993
Refrigerant handling and safety measures: Charging unit with transfer pump, portable leak detectors, explosion-proof industrial vacuum pump, disposal unit, and technical service equipment kit including recovery machine, portable ventilator and scale, emergency exhaust system and a connected monitoring control centre, fixed flammable refrigerant leak detectors, and additional measures including anti-static paint, grounding, and charging area adaptations	160,200	132,000	130,800
Installation and demonstration of two units charged with HFC-free technologies at an end-user facility in the grain, seed or pharmaceutical conservation sector (Conela) and one rack house unit at an industrial food plant (NTC Cooling)	81,000	0	61,000
Technical assistance, monitoring, outreach and dissemination of low-GWP solutions in the industrial refrigeration sector	50,000	18,000	20,000
Contingencies	36,050	18,962	23,679
Total	**396,546**	**208,583**	**260,472**
HFC phase-out (mt)	**20.12**	**9.96**	**12.44**
Cost-effectiveness (US $/kg)	**19.71**	**20.94***	**20.94**

[6] During the project review process, it was determined that the use of HFCs in the product targeted was 490 kg.

*During the project review, it was clarified that only one product with consumption of 490 kg was going to be converted, rendering the cost-effectiveness of the project as submitted at US $426/kg.

Regulatory actions and servicing sector

51. Regulatory and policy developments as well as activities proposed for implementation in the servicing sector, and their cost breakdown, are presented in table 8.

Table 8. Regulatory actions and servicing sector activities and their costs in stage I and in the first tranche of stage I of the KIP for Brazil, as submitted

Activity	Cost (US $)	
	Stage I	1st tranche
1. Regulatory actions (UNDP): Impact analysis for the establishment of legislation on (1) refrigerant GWP limits per equipment type and sector, and (2) refrigerant life-cycle management, including inter alia recovery, recycling and reclaim (RRR) and environmentally adequate destruction, traceability and incentives for RRR flows; introduction of bans on the manufacturing and import of domestic refrigeration equipment containing HFC-134a and on the manufacturing and import of residential AC equipment containing R-410A, as of 2030; awareness-raising campaign for importers on the proper classification of sectoral uses of controlled substances in the licensing process; establishment of a multi-stakeholder (public, private, civil society) working group to support Kigali Amendment implementation, promote dialogue, and ensure a coordinated, transparent, and aligned policy development; adoption or adaptation of international standards on the safe use of flammable refrigerants in the commercial refrigeration, AC, MAC and heat pump subsectors and support for the review and updates of existing standards; support for the updates and implementation of energy-efficiency labelling standards for RAC equipment; establishment of a policy for the supermarket sector to transition to energy-efficient low-GWP refrigeration systems, with focus on operational safety and economic feasibility; establishment of a policy for HFC banks management; and a complementary assessment and improvement of the data collection process on HFC use distribution	510,000	250,000
Subtotal 1	***510,000***	***250,000***
2. Activities in the commercial refrigeration servicing sector (UNDP):		
2.1. Demonstration of modular chillers with low NH_3 charge in commercial refrigeration systems in supermarkets: Development of a chiller with a local manufacturer and installation of 3 indirect-expansion systems combining NH_3 (10 kg charge) and subcritical CO_2 at 3 end users (increased to 5 during review) (US $1,078,000); performance monitoring, publication of project results, and dissemination of results in the supermarket sector (US $295,002)	1,373,002	108,000
***2.2. Reduction of HFC leakage and energy consumption in supermarkets through the use of digital tools*:** Selection of 6 supermarkets with high HFC leakage rates (increased to 15 during review) and audit of leaks and energy consumption (US $60,000); installation of smart meters, sensors and transducers and data collection on refrigerant leakage and energy use following the installation of sensors (US $228,000); technical assistance for the operation of sensors, monitoring, analysis and dissemination of results, including development of a technical bulletin and guidelines for the supermarket cold-chain sector (US $338,000)	626,000	85,000
Subtotal 2	***1,999,002***	***193,000***

Activity	Cost (US $)	
	Stage I	1st tranche
3. Activities in the MAC servicing sector: Capacity building for vocational technical schools and MAC technicians on the proper and safe handling of refrigerants during maintenance activities through development of teaching material and dissemination of results (US $335,196); training of 8 instructors (increased to 10 during review) from 4 vocational schools and 2,400 student technicians (increased to 4,000 during review) in the mandatory practices for MAC system maintenance and failure diagnosis (US $1,722,000); technical assistance and procurement of equipment[7] for 4 vocational schools (increased to 5 during the review) (US $940,000); preparation of a proposal for a technician QCR scheme, monitoring and evaluation of training, and technical assistance (US $640,000); delivery of equipment/tools[8] for 90 independent workshops (increased to 200 during the review) (US $1,530,000); feasibility study for the use of low-GWP refrigerants in MAC systems and development of a secondary-system prototype with R-290 (US $550,000); and contingencies (US $284,000)	6,001,196	1,735,196
Subtotal 3	***6,001,196***	***1,735,196***
4. Activities in the AC servicing sector (UNDP):		
4.1. Demonstration of VRF equipment charged with CO_2 in commercial buildings: Installation, operation and maintenance of CO_2-based VRF AC units (50 to 100 kW per system) at 4 end users in 4 regions to demonstrate technical, operational and economic feasibility (US $820,000); technical assistance, monitoring of performance, publication of a technical bulletin and dissemination of results (US $388,001)	1,208,001	0
4.2. Demonstration of split R-290-based AC units: Installation of 160 split AC units (3.52 kW) at 8 public schools to evaluate technical and operational feasibility and safety, including laboratory tests for the validation of energy efficiency (US $312,300); monitoring of performance, operation, maintenance and technical assistance (US $208,000); and data analysis, technical assistance, publication and dissemination of results (US $347,797)	868,097	240,199
4.3. Study and assessment of cooling systems for data centres: Market analysis and design of a technical, economic and environmental feasibility study on the use of low-GWP refrigerants in data centres (US $80,002); development of thermal models for 2 cooling systems, energy performance simulations, life-cycle assessment, and economic and life-cycle cost modeling (US $70,000); technical, economic and environmental comparative analysis of alternatives (US $50,000); and development of a project proposal for technology application in a real case, including financing sources (US $50,000)	250,002	0
Subtotal 4	***2,326,100***	***240,199***
5. Activities in the industrial refrigeration and heat pump servicing sectors (UNIDO)		
5.1. Demonstration of two industrial low-charge NH_3-based refrigeration systems combined with high-temperature HC heat pumps at two end users: Product development (US $160,000); equipment and installation at 2 end-user sites (US $1,306,217); safety equipment, measures and first aid kits (US $95,000); risk assessment and installation certification (US $100,000); technical team training (US $40,000); monitoring of performance (US $30,000); contingencies (US $203,522)	1,934,739	0
5.2. Technical assistance to the industrial refrigeration sector for the adoption of low-GWP technologies: Stakeholder meetings and sector mobilization (US $54,000); production and dissemination of informational material and technical publications, awareness-raising, outreach and communication on low-GWP alternatives in the sector (US $120,000); technical missions and workshops with experts, manufacturers	304,000	0

[7] Eight refrigerant recovery and recycling training equipment for HFC-134a and eight for HFO-1234yf, 16 training benches, four sets of component kits and tools for practical classes, installation and training, infrastructure upgrades, and facility certification.

[8] Ninety (90) charging machines and refrigerant analyzers

Activity	Cost (US $)	
	Stage I	1st tranche
and regulatory bodies (US $70,000); technical study on the feasibility of industrial refrigeration systems using low-GWP refrigerants (US $60,000)		
5.3. Training and qualification for the use of low-GWP refrigerants in residential and commercial heat pumps: Training material and guides, train-the-trainers workshop and training of 300 technicians (US $192,500); provision of equipment[9] for a technical school selected to carry out training and to serve as a reference centre for future capacity-building and training activities (US $185,000); applicability study of low-GWP technologies in heat pumps for water heating in residential and commercial installations (US $59,000); development of performance technical standards for residential heat pumps (US $10,000); development of audiovisual informational material (US $40,000); contingencies (US $48,650)	535,150	0
Subtotal 5	***2,773,889***	***0***
6. Activities in the commercial refrigeration and room AC servicing sectors (UK)		
6.1. Training and capacity building on the safe use of low-GWP refrigerants: Refresher train-the-trainer courses, training on the safe and efficient use of CO_2 and R-290 in commercial refrigeration equipment for 300 technicians, and of low-GWP flammable refrigerants in room AC systems for 700 technicians at 10 partner schools (increased to a total of 1,100 during review) (US $666,350 including contingencies); replacement and repair of tools and equipment at training centres (US $150,000)	816,351	0
6.2. Development of a pilot QCR scheme for RAC technicians in the commercial refrigeration subsector: Development of a QCR scheme, including thematic learning modules, in consultation with stakeholders and relevant authorities, development of the training roadmap and curricula, teaching materials for theoretical and practical training, and assessment methods and processes (US $290,000); provision of equipment and tools[10] and computer-based training units and software (US $500,000); training of at least 10 trainers and evaluators, and training, certification, and registration of at least 80 technicians (increased to 160 during review) (US $200,000)	990,000	780,000
6.3. Awareness and outreach: Preparation of a sectoral communication plan (US $20,000); information campaign for end users on energy-efficient alternatives to HFCs and updates to the dedicated website (US $150,000); workshops for regional stakeholders and participation in events, seminars and sector fairs (US $100,000); meetings with stakeholders and RAC associations (US $50,000)	320,000	182,611
6.4. Local monitoring and management: Local team (US $180,000), sampling, monitoring and data processing (US $70,000) and office infrastructure (US $25,000)	275,000	117,996
Subtotal 6	***2,401,351***	***1,080,607***
Total for regulatory actions and servicing sector activities (1 – 6)	**16,011,539**	**3,499,002**
7. Project implementation and monitoring (UNDP and UNIDO)		
UNDP: Overall coordination and monitoring of the KIP and implementation of (1) the regulatory component, (2) the light commercial refrigeration investment project and (3) servicing activities in the commercial refrigeration, AC and MAC sectors, including staff (US $910,000), verification reports (US $150,000), travel (US $170,000), coordination meetings (US $199,640) office rental and services (US $95,490), equipment furniture and supplies (US $40,000) and audit, evaluations and miscellaneous expenses (US $261,000)	1,826,130	556,299

[9] Training benches for handling flammable refrigerants, sets of tools, performance measuring instruments, and safety kits

[10] Including four computer-based training units (R290), eight electrical installation in refrigeration systems training units, tools and equipment for servicing (e.g. recovery units, vacuum pump, electronic gas detectors, portable air blower, manifolds, among others), tools and equipment for brazing and tubing, tools and equipment for electrical works, personal protective equipment and tools and equipment for hydraulic systems.

Activity	Cost (US $)	
	Stage I	1st tranche
UNIDO: Coordination and monitoring of (1) the industrial refrigeration investment projects and (2) activities in the industrial refrigeration and heat pump servicing sectors, including staff (US $363,949)	363,949	45,000
Subtotal 7	***2,190,079***	***601,299***
Total for regulatory actions and servicing sector activities and project implementation and monitoring (1 – 7)	**18,201,618**	**4,100,301**

Project implementation, coordination and monitoring

52. The project management unit (PMU) will work with implementing agencies, the NOU, and relevant stakeholders to manage, coordinate, and monitor the stage I action plan. Its responsibilities include project coordination, administration and budget control; equipment procurement and consultant contracting; project data standardization, verification, and reporting; arranging independent technical reviews and independent verification of HFC consumption; supporting supervision missions; tracking progress against commitments; and providing technical, logistical, training, and technology-transfer support. The total PMU budget for UNDP and UNIDO for stage I amounts to US $2,190,079, as shown in table 8 above.

Total cost of stage I of the Kigali HFC implementation plan

53. The budget for stage I has been proposed at US $26,492,219. The costs of activities in the refrigeration servicing sector have been proposed in line with decision 92/37. The proposed activities and cost of stage I of the KIP are summarized in table 5 above.

Implementation plan for the first tranche

54. The first funding tranche of stage I of the KIP was submitted in the total amount of US $7,356,170, as shown in table 5 above, to be implemented between July 2026 and June 2028. Detailed information on the activities to be implemented under the first tranche, including adjustments and level of funds as agreed, are presented in paragraph 105 below.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

V. Comments

Overarching strategy

Stage I duration

55. Regarding the duration of stage I of the KIP, UNDP explained that completion was proposed for 2032 rather than 2029 to ensure effective implementation of the light commercial refrigeration sector plan, among other activities. While larger enterprises are prepared to transition to R-290, many SMEs face customer resistance to flammable refrigerants and require additional time, regulatory clarity, and technical support. The Government aims to complete the full sector conversion under stage I, supported by regulations to be introduced at the end of the process; however, these will require time for development, consultation, adoption, and implementation. At the same time, the Government intends to request early preparatory funding for stage II to include activities delivering reductions beyond 2029. The regulatory measures being developed under stage I will also support future investment projects in stage II. UNDP further noted that Brazil did not undertake enabling activities for the HFC phase-down, and that some stakeholder consultations and coordination required for the development of regulations will be taking place under stage I, contributing to a longer implementation timeline.

HFC consumption in baseline years and consumption trend

56. The Secretariat observed the unusually high level of HFC imports in 2022 compared with all other years and asked whether any portion of those imports had been intended for stockpiling to meet future servicing or manufacturing needs, and whether such a portion could be quantified. UNDP responded that there was no basis to conclude that stockpiling had occurred in previous years. The peak of 79,416,087 CO_2-eq tonnes in 2022 reflected a period of market recovery following a sharp decline in consumption during 2020 and 2021 (36,869,443 and 44,068,386 CO_2-eq tonnes, respectively), which was associated with the impact of the COVID-19 pandemic on the economy. Consumption had already reached 65,627,001 CO_2-eq tonnes in 2019. The decrease observed in 2023 was partly due to the completion in 2022 of servicing activities that had been postponed during 2020 and 2021. Consumption has since resumed an upward trend in 2024 and 2025, and this growth is expected to continue. Available partial import data further suggest that HFC imports in the first quarter of 2026 exceeded those recorded during the same period in 2024 and 2025.

Reduction target

57. The Secretariat discussed with UNDP whether any additional HFC reduction had been considered by the Government of Brazil under stage I, noting that the proposed 10 per cent target for 2029 was about 23 per cent above the average HFC consumption in CO_2-eq tonnes in baseline years, and that imports peaked in 2022 compared with 2020 and 2021. UNDP informed the Secretariat that the Government considered maintaining the 10 per cent reduction target for 2029 as it was justified by Brazil's current market conditions and the substantial reductions already achieved through national efforts, as follows:

(a) Brazil is experiencing strong growth in cooling demand, with HFC consumption in 2025 (34,315 mt) already 30.5 per cent above the average HFC consumption in baseline years (26,290 mt), reflecting economic expansion and post-pandemic recovery;

(b) Significant reductions have already been achieved without Multilateral Fund support. For example, the room AC manufacturing sector has fully transitioned from R-410A to HFC-32 through domestic financing, achieving reductions estimated at over 6 million CO_2-eq tonnes. While no further near-term reductions are expected in this sector, production of room AC units grew by 36 per cent between 2023 and 2025 (from 5 to 6.8 million), with continued growth anticipated due to low penetration of these systems in Brazil; and

(c) Brazil still consumes approximately 7,000 mt of HCFCs (mainly HCFC-22), which must be phased out before 2030, with part of this demand likely shifting to HFC alternatives in servicing.

58. Based on further analysis of the information provided by UNDP, the Secretariat noted that HFC consumption in 2025 (in CO_2-eq tonnes) is already 6 per cent above the average consumption in baseline years. If this upward trend continues, the country is likely to have limited scope for additional reductions by 2029. Following further discussions, UNDP indicated that while it is not possible to achieve a larger reduction in 2029, the Government could commit to achieving a 12 per cent reduction by 2032.

Institutional, policy and regulatory framework

HFC licensing and quota system

59. In line with decision 87/50(g), UNDP has confirmed that Brazil has an established and enforceable system of licensing and quotas for monitoring HFC imports/exports in place. Quotas for 2026 and 2027 have been set at the baseline level of 72,897,680 CO_2-eq tonnes.

Technical and cost-related issues

Manufacturing

Light commercial refrigeration manufacturing sector (UNDP)

Enterprise eligibility and consumption

60. UNDP submitted the list of 116 enterprises to be included in the project. Upon review, one enterprise was removed due to initiation of operations after the cut-off date. UNDP confirmed that all remaining enterprises consumed HFCs and were eligible based on the cut-off date, but noted that fully verifying each micro enterprise individually was not feasible at that stage. As with other projects involving many SMEs, this verification could be finalized during the implementation period.

61. The Secretariat acknowledged the difficulty of verifying a large number of microenterprises at this stage but stressed the need for a clear inventory of enterprises receiving Multilateral Fund assistance, especially since some had been partially assisted under the HPMP to convert HCFC-22 products to low-GWP alternatives, but not those using HFCs. Accordingly, it was agreed that UNDP would report, with each KIP tranche request, on the validation of the eligibility of enterprises receiving assistance, for reporting to the Executive Committee. UNDP agreed to continue updating the list and ensuring that funding was only provided to eligible enterprises and manufacturing lines. Funding associated with enterprises found to be non-eligible would be returned to the Fund. This approach has proven effective for the monitoring of previously approved projects with many SMEs in the PU foam sector.

62. With respect to the implementation period extending to 2032, UNDP explained that such a timeframe was necessary based on experience gained from sector-wide technology conversion projects in Brazil, particularly those involving a large number of SMEs. UNDP will secure the cooperation of Brazil's two main sectoral associations: Brazilian Association of Refrigeration, Air-Conditioning, Ventilation and Heating (ABRAVA) and the National Association of Manufacturers of Electronic Products, to support outreach and engagement with SMEs and maximize the coverage of technical assistance activities.

Incremental costs

63. UNDP and the Secretariat held detailed discussions on the proposed equipment, technical assistance and IOCs for the 115 enterprises, resulting in the following adjustments:

(a) With regard to ICCs, the number of models requiring prototyping and testing was reduced. The unit cost of refrigerant-charging devices for microenterprises was reduced in line with comparable projects. The quantity of pressure-testing equipment for medium- and large-sized enterprises was also reduced, as was the number of ATEX vacuum pumps, since those were only required for equipment already charged with R-290. Electrical testing was not supported, as this was already carried out under baseline technology. In addition, the value of technical assistance to medium- and large-sized enterprises was reduced; and

(b) Regarding IOCs, the Secretariat based its calculations on a range of compressor sizes as principal cost drivers, while also considering savings from smaller expansion devices and heat exchangers resulting from the reduced size and lower material requirements. These calculations yielded values that were close to zero or slightly negative. UNDP explained that compressor costs were higher in Brazil and that, particularly for SMEs, negotiating lower prices was difficult because of limited production volumes. The Secretariat noted, however, that small compressors for light commercial applications were widely available, and that previous projects in the same subsector had not required IOCs. Following these discussions, IOCs were removed from the cost calculation.

64. As a result of the cost calculation, the incremental costs were reduced to US $8,940,690, i.e., above the level of funding requested by UNDP under the cost guidelines. Accordingly, the requested cost was retained at the originally submitted amount of US $7,425,000, at a cost-effectiveness of US $24.13/kg, as shown in table 6 above.

Industrial refrigeration manufacturing sector (UNIDO)

Sectoral and individual enterprise approaches under stage I

65. The Secretariat enquired whether a sectoral approach had been considered, noting that there were more enterprises in the sector. UNIDO explained that a sector-wide approach to industrial refrigeration was not feasible in stage I due to the sector's high heterogeneity, with diverse subsectors operating customized systems varying in terms of thermal requirements, processes, safety needs, and types of HFC refrigerants used, alongside significant differences in the enterprises' technical capacity and investment readiness. Stage I prioritizes targeted actions to start with enterprises that are ready, complemented with demonstration projects. This will build a foundation for broader implementation in later stages of the KIP.

Products covered by the conversions

66. During the discussion, UNIDO clarified that Conela would convert its entire product line to low-GWP technologies. NTC Cooling's initial commitment was limited to converting the rack house, representing close to 50 per cent of its HFC consumption, with no determined timeline for the conversion of the remaining products manufactured by the enterprises (i.e., parallel compressor racks, compact racks, liquid chillers and low-condensing units). Following discussions and the review of incremental costs required to meet all plant safety requirements, the enterprise confirmed its commitment to convert all remaining products during stage I with the same cost agreed.

67. On Refrisat, UNIDO indicated that the enterprise was initially prepared to convert only one product during stage I (chiller using inverter technology with a capacity below 100 kW), without requesting additional funding for the conversion of other products (liquid chillers, oil coolers, and medical/process chillers). However, the timeline for converting those remaining products was not determined. Consequently, only 490 kg of HFC consumption associated with the converted chillers could be considered under the project, rendering it cost-ineffective (i.e., US $426/kg).

68. UNIDO and the Government of Brazil considered it important to retain Refrisat within the KIP, given the enterprise's willingness to initiate conversion. Following discussions on potential support options, Refrisat committed to converting two additional products with the project: fixed-speed scroll chillers (from R-410A to R-454B); and compact chiller (from R-410A to R-290) phasing out a total of 2.25 mt (8,824 CO_2-eq tonnes) of HFCs. Refrisat will also self-fund the conversion of the remaining products, with a consumption of 7.71 mt, during stage II. It was agreed that only the HFC consumption to be phased out during stage I would be counted under the current project, and UNIDO would report on the completion of the remaining conversions during stage II, at which point the outstanding consumption (7.71 mt or 15,266 CO_2-eq tonnes) would be deducted from the remaining eligible consumption. To facilitate the accelerated conversion of Refrisat's products, it was further agreed that the enterprise could conduct product testing at an end-user site, similar to the demonstrations proposed by Conela and NTC Cooling.

Incremental costs

69. In line with the cost guidelines, investment projects in the industrial refrigeration manufacturing sector are considered on a case-by-case basis. The Secretariat and UNIDO held detailed discussions on the proposed equipment and technical assistance costs for the three enterprises. As a result, charging units and transfer pumps were removed from the projects, they were not necessary for the refrigerant charging process given the specified equipment size and production volumes. At the same time, additional safety measures

not included in the submitted proposals were incorporated, including additional exhaust systems for different lines, additional refrigerant sensors and safety audits.

70. Regarding the demonstration projects included in Conela and NTC Cooling projects, because these activities focus on end users, they were removed from the investment projects and incorporated into the servicing sector component implemented by UNIDO (Component 5) at US $5.10/kg, along with all other activities and demonstration projects at end users. Accordingly, the incremental costs of conversions at the three enterprises only include ICCs, as shown in table 9.

Table 9. Cost breakdown of the industrial refrigeration conversion projects (US $)

Activity	Conela	Refrisat	NTC Cooling
Development of equipment based on alternative refrigerants: • Conela: As submitted • Refrisat: Variable speed chillers (from R-410A to R-290); fixed-speed scroll chillers (from R-410A to R-454B); and compact chiller (from R-410A to R-290). Enterprise will convert self-funded its remaining HFC-based products in stage II of the KIP • NTC Cooling: Rack house (from R-404A and HFC-134a to R-290). Enterprise will convert parallel compressor racks, compact racks, liquid chillers and low-condensing units self-funded during stage I of the KIP	69,296	24,993	24,993
Refrigerant handling and safety measures: Charging unit with transfer pumps removed, additional safety equipment and safety audit included	156,700	123,200	162,200
Installation and demonstration of converted products at end-user sites	*	*	*
Technical assistance, monitoring, outreach and dissemination of low-GWP solutions in the industrial refrigeration sector	50,000	20,000	20,000
Contingencies	14,170	11,320	14,720
Total	**290,166**	**179,513**	**221,913**
HFC phase-out (mt)	**20.12**	**2.25**	**12.44**
Cost effectiveness (US $/kg)	**14.42**	****79.78**	**17.84**

*Activity moved to Component 5 in the servicing sector

**An additional 7.71 mt (15,266 CO_2-eq tonnes) will be phased out by the enterprise at no additional cost to the Fund during stage II of the KIP, achieving a cost-effectiveness of US $18.02/kg once all products are converted.

71. The conversion projects considered only ICCs, with no request for IOCs. Although R-290 systems use lower refrigerant charges, they remain more expensive than R-410A systems due to higher component costs, limited economies of scale associated with early-stage market adoption, and additional expenses related to handling procedures and mandatory safety features required to address flammability risks.

Non-investment activities in the servicing sector

Component 1: Regulatory framework

72. The Secretariat noted that stage I of the KIP included a strong regulatory component with concrete measures to support HFC phase-down. Discussions with UNDP identified additional activities to strengthen HFC data recording and reporting, as discrepancies were found between CP and survey data, particularly on sector-wise use.

73. Upon revision of the data based on survey results, UNDP explained that discrepancies were mainly due to challenges in accounting for locally blended HFCs as well as reliance on self-reported information from importing enterprises through IBAMA. A normative instruction currently under revision will require importers to report end uses and domestic blending, which should improve data quality, with further efforts planned during stage I implementation.

74. The Secretariat noted that, although there was already good understanding of HFC use in the market, further work in this area would help improve systems to record use per sector and classify a portion of HFC consumption currently recorded under unidentified uses. Upon discussion of those issues, it was agreed to include in this component activities to further strengthen import monitoring and sector-wise use recording and reporting, improve understanding and tracking of blending practices (i.e., operators, blends and amounts produced, destiny of the blends, recording systems), and enhance reporting, including training for relevant inspection officers. UNDP also informed the Secretariat that additional impact regulatory studies would be incorporated to reduce the use of high-GWP refrigerants.

Component 2: Commercial refrigeration servicing sector (UNDP)

Demonstration of modular chillers with low NH_3 charge in commercial refrigeration in supermarkets

75. Upon request, UNDP explained that the systems to be demonstrated at each end user were configurations of three chillers modules (55.9 kW) based on NH_3 and glycol as secondary refrigerant, integrated into a cascade system with subcritical CO_2. Each system is expected to replace a parallel compressor rack for medium temperature, charged with 100 kg of HFC-134a, by modular NH_3 chillers, and a parallel compressor rack for low temperature, charged with 200 kg of R-404A, by a subcritical CO_2 system co-financed by the beneficiary.

76. The Fund will cover the cost of three modular chillers per end user (US $300,000), while each beneficiary will contribute approximately US $350,000 for: the subcritical CO_2 system for low-temperature applications, glycol pumping, electrical and civil upgrades, replacement of incompatible equipment, safety and monitoring systems, installation and commissioning, engineering design, permits, and operational monitoring for data collection and dissemination. This co-financing may be higher, as end users will also finance any additional NH_3 modules required for medium-temperature applications, in line with the objective that beneficiary supermarkets operate exclusively with low-GWP refrigerants.

77. UNDP further explained that the project complemented the earlier demonstration of modular chillers based on R-290, carried out under the HPMP. Low-charge NH_3 modular chillers would provide an additional low-GWP option and the project will help address concerns about NH_3 use in supermarkets. The project will inform stage II of the KIP, when manufacturers will be targeted, while stage I will establish GWP-based sectoral guidelines to support a predictable and smooth transition. Replication potential is significant, as seen by the uptake of R-290 modular chillers under the HPMP. Brazil has over 96,000 supermarkets and 475,000 smaller food retail outlets using HFC-based systems, alongside the growing environmental, social and governance (ESG) framework-driven demand among large retailers. The higher energy efficiency of NH_3 solutions, the flexibility of modular systems across different supermarket sizes and the potential regional uptake across Latin America further support replication.

78. The Secretariat noted that the development of R-290 modular chillers under the HPMP had already led to their adoption by 60 supermarkets, which now operate without HFCs. During the review of servicing sector activities, it was agreed to streamline lower-impact activities in other projects and reduce budget lines related to technical bulletins and dissemination in this project. At the same time, the number of end users was increased from three to five to broaden the range of locations and operating conditions. As a result, the budget was adjusted from US $1,373,002 to US $1,983,000, with funds allocated from other activities.

79. In line with decision 92/36(g), UNDP is requested, upon completion of the demonstration projects at end users included in the KIP, to submit a final report on their implementation, including the HFC phase-out and energy-efficiency gains achieved.

Reduction of HFC leakage and energy consumption in supermarkets through the use of digital tools

80. UNDP explained that the project would provide digital monitoring and control systems to six medium-sized (2,000–3,000 m²) supermarkets to reduce HFC leakage and improve system efficiency and reliability. Each supermarket will be equipped with an integrated network of around 70 Internet-of-things-enabled sensors[11] to monitor the thermodynamic, operational, and environmental parameters such as temperature, pressure, refrigerant flow, compressor performance, humidity, and CO_2 levels. The system will apply real-time analytics along with diagnostics based on artificial intelligence to enable indirect leak detection, operational optimization and predictive maintenance. Each set (US $30,000) includes sensors, energy meters, a supervisory platform, and data analysis software. Sensors will be installed in central systems, points of sale and storage areas. Collected data will be analysed and shared for replication. Co-financing from beneficiaries will cover the required upgrades, including control systems, software integration, and supporting infrastructure.

81. Given the high supermarket leakage rates (around 45 per cent annually), the potential replicability of the proposed solution (over 96,000 supermarkets and a relatively low cost that will result in savings when purchasing new refrigerant), and the need to demonstrate it under diverse conditions in a large country like Brazil, the Secretariat and UNDP agreed to increase coverage to 15 supermarkets. This was achieved by rationalizing other cost components, removing an ESG guide proposed, and reallocating funds from other activities. The final agreed cost is US $967,833.

Component 3: Mobile air-conditioning servicing sector (UNDP)

82. The Secretariat and UNDP held detailed discussions on the component's objective and approach, and agreed on several adjustments to activities to maximize their impact within the available resources, in particular by extending training and tools to the largest possible number of technicians, noting that over 50 per cent of HFC-134a consumption in the country was in this sector and that, to date, no activities had consistently targeted this sector.

83. As a result of discussions, the number of vocational schools to be strengthened with tools and equipment[12] was increased from four to five, the number of trainers from eight to 10, the number of trainees was increased from 2,400 to 4,000, and the number of workshops to receive tools was expanded from 90 to 200, within the existing overall budget. This was achieved by incorporating co-financing from schools for the installation and upgrades of civil and electrical infrastructure, providing training for MAC instructors in Brazil through an international expert rather than at international institutions; streamlining the development of MAC training materials; and reducing the scope of the feasibility study on the use of low-GWP refrigerants in MAC systems.

84. Regarding the proposed QCR scheme for MAC technicians, the Secretariat enquired whether actual certification of technicians could be included in stage I of the KIP. UNDP noted that, for the MAC sector, which had not been assisted under the HPMP, stage I would focus on developing methodology, curriculum framework and training materials, with certification for technicians to become operational in the next stage.

85. The Secretariat sought clarification on the development of an R-290 secondary-system prototype for automotive use, noting that most manufacturers of passenger vehicles were non-Article 5-owned and might have their own technology development programmes. UNDP explained that the project would target buses, developing a prototype with a national manufacturer and research centre to generate technical and safety data to demonstrate feasibility, engage with manufacturers' research and development centres, and

[11] Smart sensors connected to a network (e.g., Internet, Wi-Fi or Bluetooth) and sharing data in real time, enabling remote monitoring or automated reaction.

[12] Eight refrigerant recovery and recycling training equipment for HFC-134a and eight for HFO-1234yf, 16 training benches, four sets of component kits and tools for practical classes, installation and training, infrastructure upgrades, and facility certification.

inform future engineering decisions and transition pathways for both light-duty vehicles and buses. Given Brazil's national manufacturing specifications and unique models, the results will be relevant, with potential adoption by national manufacturers, including bus producers. The prototype will be installed in a new vehicle to facilitate integration, avoid costly modifications, and allow accurate comparison with the HFC-based system. The project will also support policy development for the MAC sector, including potential standards for public transport bus fleets.

Component 4: Air-conditioning servicing sector (UNDP)

Demonstration project on the use of CO_2-charged VRF equipment in commercial buildings

86. During the discussion, UNDP explained that the project aimed to support technological leapfrogging in a rapidly expanding sector by introducing a low-GWP alternative, thus helping prepare stakeholders (manufacturers, installers, designers, and regulators) for future KIP phases. It will also generate technical data (on, e.g., safety, installation standards and energy performance) to inform regulatory development and guide future KIP activities. The Secretariat raised a concern about the replicability of the demonstration, noting that CO_2-based VRF technology was still largely considered in prototype or pre-commercial stages by many manufacturers and presented challenges related to its performance, complexity, and cost. UNDP responded that the technology was commercially available in one non-Article 5 region and that equipment would be imported from abroad.

87. It was also noted that there was an immediate need to ensure the safe adoption of A2L-based VRF systems entering the local market to replace R-410A systems, including appropriate training, standards, and regulations for their installation, maintenance, and decommissioning. Taking this into account, it was agreed to demonstrate more than one technology option. Given the early-stage development and higher cost of CO_2-based VRF systems in Article 5 countries, their demonstration was reduced to a single site to assess future potential adoption of low-GWP technology. In parallel, A2L-based VRF systems[13] will be demonstrated at two sites to collect data; provide immediate, practical alternatives; and build capacity needed for the adoption of A2L technology. The revised activity includes the development of regulatory measures and a technical report outlining mandatory practices for A2L-based VRF systems. The funds agreed for this activity were reduced to US $650,600, with remaining funds allocated to other components.

Demonstration of split R-290-based AC units

88. The Secretariat enquired about the need for this demonstration, given that local manufacturing enterprises had recently transitioned to HFC-32. UNDP clarified that the sector viewed the transition to HFC-32 as temporary and acknowledged the need for future alternatives. Manufacturers and their association expressed willingness to engage in further discussions on this issue and to closely monitor the project's implementation in order to gain practical experience on the technology. Potential beneficiaries have also shown interest. The demonstration will assess the performance, safety and feasibility of R-290 systems, support the development of technical protocols and raise stakeholder awareness. Overall, the project aims to address key barriers, including the regulatory, technical, and market constraints, that currently hinder the adoption of low-GWP refrigerants.

89. Following further discussions, the component was revised to include co-financing from end users/training institutions for installation, infrastructure adaptation and maintenance cost. This activity will also include an exchange visit for manufacturers to a country that produces R-290 AC units, enabling them to gain practical insights, facilitate knowledge-sharing, support informed decision-making and encourage

[13] Small-capacity VRF/variant refrigerant volume outdoor unit in the 4 HP class, designed to supply multiple indoor units through a shared refrigerant distribution network, with inverter compressor and SEER values above 7, optimized heat exchangers and intelligent load management.

manufacturers to consider transitioning at a later stage of the KIP. With adjustments to the proposal, the final cost was reduced to US $743,400, with the remaining funds reallocated to other components.

Study and assessment of cooling systems for data centres

90. Regarding the rationale for this activity, UNDP explained that Brazil was currently the eighth-largest data centre market globally, with the sector rapidly expanding. As there is limited information on how the sector operates, including its supply chains and technology choices, there is a need for structured engagement and evidence-based guidance to help avoid the growth of high-GWP, HFC-based technologies in this sector. The proposed activity includes technical analysis to identify and assess sustainable, energy-efficient cooling solutions, including low-GWP alternatives. It will also improve the understanding of technical, economic, and environmental trade-offs associated with each technology and explore potential business models to support the uptake of sustainable cooling solutions in the sector.

91. The project will establish a platform to facilitate coordinated decision-making among the industry and the Government. The Brazilian Data Centre Association and ABRAVA will support broad dissemination of results and stakeholder engagement. It was agreed that the project would provide recommendations on potential policy and regulatory measures to promote the adoption of energy-efficient, low-GWP technologies and guide decision-making on cooling solutions for future data centre construction.

Component 5: Industrial refrigeration and heat pump servicing sector (UNIDO)

92. The first activity under this component will demonstrate, at two industrial sites, refrigeration systems with low NH_3 charges combined with high-temperature water-to-water HC heat pumps to recover industrial waste heat. The Secretariat and UNIDO discussed key technical parameters, including minimum capacities of the systems agreed at 176 kW (cooling) and 113 kW (heating), the role of a local manufacturer in developing and supplying the equipment, and end-user co-financing. The manufacturer will co-finance part of product development, while each end user will contribute over 50 per cent of project costs (US $990,500 each), covering components such as pumping stations and indirect systems, blast freezers (compressors, piping, tanks, expansion valves), low-temperature warehouses, dismantling of HFC-based systems, logistics, installation, and commissioning.

93. UNIDO will monitor system performance, including energy efficiency, against baseline technologies over six months, with results shared with manufacturers and end users through technical activities. UNIDO confirmed that, under stage I, national standards will be updated and harmonized to establish a legal and safety framework for refrigerants such as R-290, NH_3, and CO_2. In parallel, legislation introducing maximum GWP limits by equipment type or sector will be developed to support the adoption of these technologies. In line with decision 92/36(g), UNIDO is requested, upon completion of the demonstration projects at end users included in the KIP, to submit a final report on their implementation, including the HFC phase-out and energy-efficiency gains achieved.

94. The second activity under this component was technical assistance to the industrial refrigeration sector for the adoption of low-GWP solutions, focussing on meetings with key stakeholders, development of outreach materials, organization of awareness workshops, dissemination of the results of the demonstration projects in industrial refrigeration and development of a feasibility study for the sector, aiming to address technical and financial barriers through the development of a bankable feasibility report. The third activity under this component was strengthening capacity of training centres and training of technicians on industrial refrigeration and heat pumps, also including residential and commercial ones. A portion of the funds initially allocated to the technical assistance activity were reallocated to the training activity to expand the training from 300 to 700 technicians, and to activities aimed at mapping the cold chain in the industrial refrigeration sector, including information on HFC use, end users, service providers, technicians serving the sector, technologies used and barriers to their introduction.

95. The demonstration activities related to the investment projects for Conela, NTC Cooling and Refrisat were moved to this component. A total of US $303,000 were allocated for the following activities:

(a) Four units manufactured by Conela (monoblock, chiller or self-out refrigeration system) will be demonstrated at end-user sites, with co-financing provided by beneficiaries estimated at US $74,000, including the remaining units to reach the installation heat load, pumping station and indirect system with fan coil units, logistics, installation, adaptation, and proper disposal of HFC-based systems including refrigerant recovery;

(b) Two rack house operating with R-290/CO_2 in cascade refrigeration will be demonstrated at two end-user sites, with co-financing provided by the beneficiary estimated at US $186,000 each, including pumping station and indirect system with fan coil units and evaporators, logistics, installation and proper disposal of HFC-based systems including refrigerant recovery; and

(c) A demonstration of at least two Refrisat products at end user sites was included to facilitate the conversion of more products by the enterprise. UNIDO will follow the same principles for co-financing as were determined for the other two enterprises.

96. All the demonstrations will include monitoring of performance (including energy efficiency) of those systems against baseline technology for a six-month period, and results will be disseminated to manufacturers, refrigeration technicians, technical schools, regulatory bodies, and industry associations through technical bulletins, manuals, guides, workshops, and other means.

97. Based on the above discussion, together, the cost of activities 1 (heat pump demonstration) and 2 (technical assistance) was adjusted from US $2,238,739 to US $1,704,000, while the cost of activity 3 (training) increased from US $535,150 to US $866,889. In addition, the demonstrations of equipment produced by Conela, Refrisat and NTC Cooling, initially planned under the investment projects, were moved to this component at a cost of US $303,000. With these adjustments, the overall budget increased from US $2,773,889 to US $2,873,889.

Component 6: Commercial refrigeration and residential AC servicing sector (United Kingdom)

98. The technician training and procurement of equipment/tools under stage I were designed to complement and expand to additional technicians the ongoing training programme implemented under stage III of the HPMP.[14] A QCR scheme for the residential AC sector is being developed under stage III of the HPMP and stage I of the KIP is proposing to develop QCR scheme for the commercial refrigeration sector. Both QCR pilot schemes will be implemented in close coordination, with the ultimate objective of establishing a self-sustaining, national-level QCR system in the long term. During the discussion, the number of technicians to be trained was increased from 1,000 to 1,100 and the number of certified technicians proposed was increased from 80 to 160, within the originally requested budget.

Calculation of reductions from the starting point in HFC consumption

99. Based on the cost of activities in the servicing sector, agreed at US $16,578,594, reductions from the remaining HFC consumption eligible for funding in the sector amount to 6,637,990 CO_2-eq tonnes, as summarized in table 10.[15] Accordingly, the Government of Brazil has agreed to reduce its 2029 HFC consumption to 65,607,912 CO_2-eq tonnes, representing 10 per cent of the country's HFC baseline for compliance.

[14] A total of 4,900 technicians were trained under stage I, followed by 11,845 under stage II. An additional 18,000 technicians are currently undergoing training in stage III. To support these efforts, 28 training centres have been strengthened to deliver the programme.

[15] Calculated in line with the methodology presented in annex I of document UNEP/OzL.Pro/ExCom/92/46.

Table 10. Agreed costs and reductions from HFC consumption eligible for funding and final target

Servicing sector		
Average HFC consumption in the servicing sector in baseline years	mt	13,224.14
	CO_2-eq tonnes	27,003,909
Average GWP of all HFCs consumed in the sector		2,042.02
Agreed funding	US $	16,578,594
Agreed cost-effectiveness threshold	US $/kg	5.10
Reductions in the servicing sector	mt	3,250.70
	CO_2-eq tonnes	6,637,990
Reductions from all sectors		
Established HFC consumption baseline	CO_2-eq tonnes	72,897,680
Reductions achieved through conversions in the manufacturing sector	CO_2-eq tonnes	651,778
Reductions achieved through activities in the servicing sector	CO_2-eq tonnes	6,637,990
Target		
2029 target	CO_2-eq tonnes	65,607,912
2032 target (during the discussions, the Government of Brazil agreed to have an additional 2 per cent reduction in 2032, bringing the total reduction to 12 per cent. This is equivalent to 1,457,954 CO_2-eq tonnes, for which no funding was requested)	CO_2-eq tonnes	64,149,958

100. The agreed cost of US $16,578,594 to reduce 6,637,990 CO_2-eq tonnes in servicing based on the methodology used for all KIPs, is larger than the US $16,011,539 initially requested. The additional funding was allocated to allow the adjustments and output increases agreed under the servicing component, as summarized in table 11. The increase in servicing was offset by the reductions in investment projects and the PMU.

Table 11: Adjustments to stage I activities and costs, as agreed

	Component details and adjustments	Agency	Cost (US $)	
			Submitted	Agreed
	Investment projects			
	Light commercial refrigeration manufacturing sector (conversion of 116 enterprises) – revised to 115 enterprises as one was ineligible, the recommended cost kept within the prescribed guidelines	UNDP	7,425,000	7,425,000
	Industrial refrigeration manufacturing sector (conversion of 3 enterprises) – cost revised upon review of ICCs, adjustment on number of products converted by Refrisat, demonstrations on end users moved to servicing (Component 5)	UNIDO	865,601	691,592
	Non-investment projects			
1	Regulatory actions - additional activities included to strengthen import monitoring and sectoral use reporting, improve tracking of blending practices and enhance reporting through training, and added regulatory impact study	UNDP	510,000	707,322
2	Commercial refrigeration servicing sector – number of end users increased from 3 to 5 in demonstration of chillers; number of supermarkets increased from 6 to 15 for demonstration of digital tools for leakage reduction	UNDP	1,999,002	2,950,833
3	MAC servicing sector activities – training institutes assisted increased from 4 to 5, trainers from 8 to 10, technicians trained from 2,400 to 4,000, and training centres for tools from 90 to 200	UNDP	6,001,196	6,001,196
4	AC servicing sector – for VRF demonstration, CO_2-based demonstration reduced to 1 and added two demonstrations of A2L-VRF and added development of safety regulations; for residential AC demonstration project 160 units maintained,	UNDP	2,326,100	1,644,002

Component details and adjustments		Agency	Cost (US $)	
			Submitted	Agreed
	co-financing was increased and an exchange visit was added; for data centres, the project would also provide recommendations on potential policy and regulatory measures to promote the adoption of energy-efficient, low-GWP technologies			
5	Industrial refrigeration and heat pump servicing sectors – cost of some items optimised and number of technicians for training increased from 300 to 700. Demonstrations moved from investment projects: the number of equipment for demonstration at end user sites increased from 3 to 5 for Conela, from 1 to 2 for NTC cooling, and added 2 end users for Refrisat	UNIDO	2,773,890	2,873,890
6	Strengthening capacities of technicians and training centres and pilot project for certification of technicians, focusing on commercial refrigeration and room AC servicing sector – number of technicians to receive training increased from 1,000 to 1,100 and number of technicians to be certified increased from 80 to 160	UK	2,401,351	2,401,351
	Total non-investment		**16,011,539**	**16,578,594**
Project implementation and monitoring – cost optimised and reduced from 8.2 to 6.8 per cent of total project cost		UNDP	1,826,130	1,509,631
		UNIDO	363,949	287,402
Total			**26,492,219**	**26,492,219**
Subtotal for UNDP			**20,087,428**	**20,237,984**
Subtotal for UNIDO			**4,003,440**	**3,852,884**
Subtotal for the Government of UK			**2,401,351**	**2,401,351**

Project management unit

101. Upon discussion, considering the simultaneous implementation of the HPMP and the KIP up to 2030, and considering overall project cost, the funding for the PMU was agreed at US $1,797,003, amounting to 6.8 per cent of total project cost. It includes staff (US $910,000); verification reports (US $90,000), travel (US $170,000), coordination meetings (US $95,000), office rental and services (US $95,490), equipment furniture and supplies (US $40,000) audit, evaluations and miscellaneous expenses (US $109,141), and the coordination and monitoring of industrial refrigeration investment projects and activities (US $287,402).

Total project cost

102. At a total cost of US $26,492,219, stage I of the KIP for Brazil will result in a reduction of 7,289,768 CO_2-eq tonnes from the country's HFC consumption eligible for funding, as summarized in table 12.

Table 12. Agreed cost of activities to be implemented during stage I of the KIP for Brazil

Sector	Substance	Phase-out		Cost (US $)	CE* (US $/kg)
		mt	CO_2-eq t.		
Light commercial refrigeration	HFC-134a, R-404A	307.77	539,775	7,425,000	24.13
Industrial refrigeration	HFC-134a, R-404A, R-410A				
Conella	HFC-134a, R-404A, R-410A	20.12	57,274	290,166	14.42
Refrisat**	R-410A	2.25	8,824	179,513	79.78
NTC Cooling	HFC-134a, R-404A	12.44	45,905	221,913	17.84
Servicing	Several	3,250.70	6,637,990	16,578,594	5.10

Sector	Substance	Phase-out		Cost (US $)	CE* (US $/kg)
		mt	CO_2-eq t.		
PMU		-	-	1,797,033	-
Total		**3,593.28**	**7,289,768**	**26,492,219**	**7.37**

*CE=cost-effectiveness

**An additional 7.71 mt (15,266 CO_2-eq tonnes) will be phased out by the enterprise at no additional cost to the Fund during stage II of the KIP, achieving a cost-effectiveness of US $18.02/kg once all products are converted.

103. In addition, the Government of Brazil committed to achieve an additional 2 per cent reduction from the baseline in 2032, bringing the total reduction to 12 per cent. This is equivalent to 1,457,954 CO_2-eq tonnes, for which no funding was requested.

104. Stage I of the KIP will be implemented in three tranches.

Implementation plan for the first tranche of the Kigali HFC implementation plan

105. The agreed plan of action, amounting to US $8,734,984, will include the following activities:

(a) *Commercial refrigeration manufacturing (UNDP):* Initiation of conversion of the light commercial refrigeration sector enterprises to the use of low-GWP refrigerants, monitoring and technical assistance (US $3,080,000);

(b) *Industrial refrigeration manufacturing sector (UNIDO):* Project alignment with beneficiary enterprises, prototype development, end-user project, installation monitoring, specification, procurement, and services, procurement and installation of equipment (US $316,780);

(c) *Regulatory actions (UNDP)*: Meetings with associations, participation in working groups and sectoral discussions; awareness activities and workshops to disseminate results of the regulatory impact analysis; and development of standards and sectoral awareness activities (US $250,000);

(d) *Commercial refrigeration servicing sector (UNDP)*: Development of a chiller for the demonstration project on the use of NH_3 in refrigeration installations in the supermarkets (US $450,000); selection of beneficiaries and audit of their refrigeration and energy systems, monitoring and technical assistance for the project to reduce HFC leaks and energy consumption in supermarkets through digitalization of refrigeration systems (US $188,000) (total of US $638,000);

(e) *MAC servicing sector (UNDP)*: Development of training materials, selection of schools, training of instructors, procurement of equipment and tools, monitoring and technical assistance for the training on the proper and safe handling of refrigerants during the installation and maintenance of MAC systems, and technical support for independent workshops (US $1,377,540);

(f) *AC servicing sector (UNDP)*: Procurement of split air conditioners using R-290; laboratory testing to validate their energy performance in accordance with national standards; installation, monitoring and technical assistance for the demonstration project on sustainable AC using HC-290 (US $247,500);

(g) *Industrial refrigeration and heat pump servicing sector (UNIDO):* Prototype development and alignment with supplier, specification and procurement processes, and acquisition of required equipment; stakeholder meetings and development of informational and training

materials, selection of a technical institute to provide training, training of trainers, procurement of equipment and tools, and monitoring (US $1,149,557);

(h) *Strengthening the capacity of technicians and training centres, and a pilot project for a technician QCR scheme in commercial refrigeration and room AC servicing sectors (UK):* Consultant contracting, stakeholder consultations, curricula and training materials development, lab setup with equipment and tools, and training/certification of 10 trainers and 100 technicians; and outreach in the form of a sector communication plan and materials, publications and videos, website/social media management, regional dissemination of results, trade shows and events, stakeholder meetings at national/regional levels, management, monitoring, data processing, quality control and reporting (US $1,080,607); and

(i) *Project management, monitoring and evaluation*: Staff, travel, verification report and other expenses (UNDP) (US $495,000); staff, management and monitoring, data processing, sampling, quality control, reports, other expenses (UNIDO) (US $100,000).

Co-financing

106. Beneficiary enterprises participating in investment projects in the light commercial and industrial refrigeration sectors will provide co-financing for their conversion activities. In addition, all pilot projects demonstrating low-GWP technologies at end-user sites will be co-financed by the beneficiary end users. The room AC manufacturing sector, including seven eligible enterprises, has already transitioned from R-410A to HFC-32 without requesting support from the Multilateral Fund.

2026–2028 business plan of the Multilateral Fund

107. UNDP, UNIDO and the Government of the United Kingdom of Great Britain and Northern Ireland are requesting US $26,492,219, plus agency support costs, for the implementation of stage I of the KIP for Brazil. The total value of US $20,335,987, including agency support costs, requested for the period of 2026–2028, is US $12,716,574 above the amount in the business plan.

Gender policy implementation

108. In line with decisions 84/92(d), 90/48(c) and 92/40(b), Brazil is integrating the Multilateral Fund's gender policy into its KIP. While women's participation, leadership roles, and access to training have increased, the sector remains male-dominated, with barriers such as limited representation in technical roles, cultural biases, and work-life balance constraints. The project aims to address these gaps by promoting inclusivity, increasing women's participation in technical training, certification, and decision-making roles, and supporting targeted outreach, mentorship, and communication initiatives. It also emphasizes sex-disaggregated data collection, support networks, and incentives to encourage women's entry and advancement in RAC careers. Planned activities include the implementation of specific enrollment windows at partner training institutions with reserved seats or early-access registration for women applicants to RAC training courses, build collaborations and strengthen support networks (e.g., women's groups in the RAC sector), promote men and women participation in the technical training, and incorporating testimonials of women active in the sector into communication products as a way of encouraging women participation.

Sustainability of the HFC phase-down and assessment of risks

109. The regulatory component under stage I of the KIP is designed to strengthen the existing regulatory systems and build on Brazil's well-established institutional framework, including the role of IBAMA in managing imports, which is functioning well to date. Regulatory measures include bans on the use of

HFC-134a in domestic refrigeration and light commercial applications and R-410A in residential manufacturing. These bans will ensure sustainability of low-GWP alternatives in these sectors. The planned demonstrations in commercial and industrial refrigeration, as well as domestic and commercial AC, will provide pathways and practical guidance for the market to transition to low-GWP alternatives. One key risk involves the limited availability of components for low-GWP technologies; it will be mitigated by strengthening the capacity of national component manufacturers. Another risk relates to the quality and consistency of servicing technicians, which will be addressed through the development of a QCR scheme and establishment of a broader national certification system in later stages of the KIP to ensure long-term sustainability of skills and compliance with best practices.

Impact on the climate

110. The activities proposed, including conversion of the light commercial refrigeration manufacturing sector to R-290 and of industrial refrigeration manufacturing to alternative technologies, efforts to promote low-GWP alternatives through various demonstration projects, and capacity-building for the RAC and MAC sectors, indicate that the implementation of stage I of the KIP will reduce refrigerant emissions into the atmosphere, resulting in climate benefits. A calculation of the impact on the climate of the activities in the KIP indicates that by 2029, Brazil will have reduced its emissions by approximately 7,289,768 CO_2-eq tonnes of HFCs, calculated as the difference between HFC baseline for compliance and the 2029 target, assuming that all consumed HFCs would eventually have been emitted.

Draft Agreement

111. A draft Agreement between the Government of Brazil and the Executive Committee for stage I of the KIP is contained in annex II to the present document.

Coordination of activities in the servicing sector under HCFC phase-out and HFC phase-down plans

112. Annex III summarizes the simultaneous implementation of activities under the HPMP and the KIP.

VI. Recommendation

113. The Executive Committee may wish to consider:

(a) Approving, in principle, stage I of the Kigali HFC implementation plan (KIP) for Brazil for the period 2026–2032 to reduce HFC consumption by 10 per cent of the country's baseline by 2029 and 12 per cent by 2032, in the amount of US $28,452,729, consisting of US $20,237,984, plus agency support costs of US $1,416,659, for UNDP, US $3,852,884, plus agency support costs of US $269,702, for UNIDO and US $2,401,351, plus agency support costs of US $274,149, for the Government of the United Kingdom of Great Britain and Northern Ireland;

(b) Noting the commitment of the Government of Brazil to:

(i) Ban the use of HFC-134a in the manufacturing of domestic refrigeration equipment in Brazil by 1 January 2030;

(ii) Ban the manufacturing and import of residential air-conditioning equipment containing R-410A by 1 January 2030;

(iii) Ban the manufacturing and import of self-contained commercial refrigeration equipment containing HFCs under a capacity to be determined through the

implementation of the light commercial refrigeration project by 1 January 2033;

(c) Noting also that:

(i) 7,289,768 CO_2-equivalent tonnes of HFCs will be deducted from the starting point for sustained aggregate reductions in HFC consumption that will be established on the basis of guidance provided by the Executive Committee;

(ii) Upon completion of the end-user projects included in stage I of the KIP, UNDP and UNIDO will submit final reports on the implementation of these projects, including the HFC phase-out and energy-efficiency gains achieved, in line with decision 92/36(g);

(iii) Approval of stage I of the KIP does not preclude Brazil from submitting, prior to 2029, a proposal to achieve a reduction in HFCs beyond that addressed in stage I of the KIP;

(d) Requesting:

(i) The Government of Brazil and UNDP to submit as part of the progress report submitted with the requests for each future tranche, the list of enterprises in the light commercial refrigeration sector assisted by the Multilateral Fund under stage I of the KIP, including their eligibility status, HFC consumption phased out and technologies adopted;

(ii) UNIDO to report on the completion of conversion of the remaining products from Refrisat in order to deduct 15,266 CO_2-eq tonnes from the remaining eligible consumption;

(e) Approving:

(i) The draft Agreement between the Government of Brazil and the Executive Committee for the reduction in consumption of HFCs in accordance with stage I of the KIP, contained in annex I to the present document; and

(ii) The first tranche of stage I of the KIP for Brazil and the corresponding tranche implementation plan, in the amount of US $9,394,158, consisting of US $6,088,040, plus agency support costs of US $426,163, for UNDP, US $1,566,337, plus agency support costs of US $109,644, for UNIDO and US $1,080,607, plus agency support costs of US $123,367, for the Government of the United Kingdom of Great Britain and Northern Ireland.

Annex I

HFC USE BY SECTOR AND SUBSTANCE IN BRAZIL (2024 SURVEY RESULTS)

Sector	HFC-134a	HFC-32	HFC-125	R-404A	R-410A	Others	Total	Share (%)
				Metric tonnes (mt)				
Manufacturing								
Domestic refrigeration	59.30	-	-	-	-	-	59.30	0.2
Commercial refrigeration	560.00	-	-	208.00	12.00	8.67	788.67	2.9
Industrial refrigeration	111.80	-	-	169.50	82.10	-	363.40	1.3
Transport refrigeration	56.60	-	-	132.10	-	-	188.70	0.7
Residential AC	-	1,565.00	-	-	3,222.00	-	4,787.00	17.6
MAC	1,566.17	-	-	-	-	-	1,566.17	5.7
Commercial AC	234.46	22.72	-	-	459.66	21.23	738.07	2.7
Heat pump					24.00		24.00	0.1
PU foam						8.00	8.00	0.0
XPS foam						-	-	0.0
Aerosol	450.00					-	450.00	1.7
Firefighting			25.46			24.30	49.76	0.2
Solvent						1.23	1.23	0.0
Other RAC manufacturing unidentified	1,863.02	2,082.50	-				3,945.52	14.5
Other						56.55	56.55	0.2
Subtotal manufacturing (mt)	**4,901.37**	**3,670.22**	**25.46**	**509.59**	**3,799.76**	**119.98**	**13,026.38**	**47.8**
Servicing								
Refrigeration subsectors								
Domestic	444.80	-	-	-	-	-	444.80	1.6
Commercial	502.80	-	-	1,084.97	10.20	216.63	1,814.60	6.7
Industrial	369.50	-	-	588.90	289.00	6.80	1,254.20	4.6
Transport	226.60	-	-	186.60		2.10	415.30	1.5
Air-conditioning subsectors								
Residential	-	228.00	-	-	3,214.00	-	3,442.00	12.6
Mobile	4,694.21	-	-	-	-	-	4,694.21	17.2
Other (commercial / industrial)	625.89	2.30	-	-	813.56	414.10	1,855.85	6.8
Heat pump					300.00		300.00	1.1
Subtotal servicing (mt)	**6,863.80**	**230.30**		**1,860.46**	**4,626.76**	**639.63**	**14,220.95**	52.2
Total (mt)	**11,765.17**	**3,900.52**	**25.46**	**2,370.05**	**8,426.52**	**759.61**	**27,247.33**	**100.0**

Sector	HFC-134a	HFC-32	HFC-125	R-404A	R-410A	Others	Total	Share (%)
				CO_2-eq tonnes				
Manufacturing								
Domestic refrigeration	84,804	-	-	-	-		84,804	0.2
Commercial refrigeration	800,806	-	-	815,673	25,050	12,263	1,653,792	3.4
Industrial refrigeration	159,874	-	-	664,696	171,384		995,953	2.1
Transport refrigeration	80,938	-	-	518,028	-		598,966	1.2
Residential AC	-	1,056,375	-	-	6,725,925		7,782,300	16.2
MAC	2,239,629	-	-	-	-		2,239,629	4.7
Commercial AC	335,284	15,336	-	-	959,540	22,503	1,332,663	2.8
Heat pump	-	-	-	-	50,100	-	50,100	0.1
PU foam	-	-	-	-	-	8,240	8,240	0.0
XPS foam	-	-	-	-	-		-	0.0
Aerosol	643,506	-	-	-	-		643,506	1.3
Firefighting	-	-	89,110	-	-	104,740	193,850	0.4
Solvent	-	-	-	-	-	2,017	2,017	0.0
Other RAC manufacturing unidentified	2,664,124	1,405,688	-	-	-		4,069,812	8.5
Other	-	-	-	-	-	7,159	7,159	0.0
Manufacturing of blends	-	-	-	-	-		-	0.0
Subtotal manufacturing	**7,008,966**	**2,477,399**	**89,110**	**1,998,396**	**7,931,999**	**156,922**	**19,662,792**	**41.0**
Servicing								
Refrigeration subsectors								
Domestic	636,064	-	-	-	-		636,064	1.3
Commercial	719,004	-	-	4,254,818	21,293	652,271	5,647,386	11.8
Industrial	528,385	-	-	2,309,411	603,288		3,441,083	7.2
Transport	324,038	-	-	731,751	-		1,055,789	2.2
Air-conditioning subsectors								
Residential	-	153,900	-	-	6,709,225	-	6,863,125	14.3
Mobile	6,712,720	-	-	-	-		6,712,720	14.0
Other (commercial / industrial)	895,023	1,553	-	-	1,698,307	732,011	3,326,893	6.9
Heat pump					626,250		626,250	1.3
Subtotal servicing	**9,815,234**	**155,453**	**-**	**7,295,980**	**9,658,362**	**1,384,282**	**28,309,310**	**59.0**
Total (CO_2-eq tonnes)	**16,824,200**	**2,632,851**	**89,110**	**9,294,376**	**17,590,361**	**1,541,204**	**47,972,102**	**100.0**

Annex II

DRAFT AGREEMENT BETWEEN THE GOVERNMENT OF BRAZIL AND THE EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND FOR THE REDUCTION IN CONSUMPTION OF HYDROFLUOROCARBONS IN ACCORDANCE WITH STAGE I OF THE KIGALI HFC IMPLEMENTATION PLAN

(Period: 2026–2032)

Purpose

1. This Agreement represents the understanding of the Government of Brazil ("the Country") and the Executive Committee with respect to the reduction of controlled use of Annex F substances set out in Appendix 1-A ("The Substances") to a sustained level of 64,149,958 CO_2-equivalent (CO_2-eq) tonnes by 1 January 2032 in compliance with the Montreal Protocol schedule and the terms of this Agreement.

2. The Country agrees to meet the annual consumption limits of Annex F substances as set out in row 1.2 of Appendix 2-A ("The Targets, and Funding") in this Agreement as well as in the Montreal Protocol reduction schedule for Annex F substances mentioned in Appendix 1-A. The Country accepts that, by its acceptance of this Agreement and performance by the Executive Committee of its funding obligations described in paragraph 3, it is precluded from applying for or receiving further funding from the Multilateral Fund in respect to any consumption of Annex F substances that exceeds the level defined in row 1.2 of Appendix 2-A as the final reduction step under this Agreement for Annex F substances specified in Appendix 1-A and in respect to any consumption of Annex F substances that exceeds the level defined in row 4.1.3 (remaining consumption eligible for funding).

3. Subject to compliance by the Country with its obligations set out in this Agreement, the Executive Committee agrees, in principle, to provide the funding set out in row 3.1 of Appendix 2-A to the Country. The Executive Committee will, in principle, provide this funding at the Executive Committee meetings specified in Appendix 3-A ("Funding Approval Schedule").

4. The Country agrees to implement this Agreement in accordance with stage I of the Kigali HFC implementation plan ("the Plan") as approved. In accordance with subparagraph 5(b) of this Agreement, the Country will accept independent verification of the achievement of the annual consumption limits of Annex F substances set out in row 1.2 of Appendix 2-A of this Agreement. The aforementioned verification will be commissioned by the relevant bilateral or implementing agency.

Conditions for funding release

5. The Executive Committee will only provide the Funding, in accordance with the Funding Approval Schedule, when the Country satisfies the following conditions at least 12 weeks in advance of the applicable Executive Committee meeting set out in the Funding Approval Schedule:

(a) That the Country has met the Targets set out in row 1.2 of Appendix 2-A for all relevant years. Relevant years are all years since the year in which this Agreement was approved. Years for which there are no due country programme implementation reports at the date of the Executive Committee meeting at which the funding request is being presented are exempted;

(b) That the meeting of these Targets has been independently verified for all relevant years, unless the Executive Committee decided that such verification would not be required;

(c) That the Country had submitted a Tranche Implementation Report in accordance with Appendix 4-A ("Format of Tranche Implementation Reports and Plans") covering each

previous calendar year; that it had achieved a significant level of implementation of activities initiated with previously approved tranches; and that the rate of disbursement of funding available from the previously approved tranche was more than 20 per cent; and

(d) That the Country has submitted a Tranche Implementation Plan in accordance with Appendix 4-A covering each calendar year until and including the year for which the Funding Approval Schedule foresees the submission of the next tranche or, in case of the final tranche, until completion of all activities foreseen.

Monitoring

6. The Country will ensure that it conducts accurate monitoring of its activities under this Agreement. The institutions set out in Appendix 5-A ("Monitoring Institutions and Roles") will monitor and report on implementation of the activities in the previous Tranche Implementation Plans in accordance with their roles and responsibilities set out in the same appendix.

Flexibility in the reallocation of funds

7. The Executive Committee agrees that the Country may have the flexibility to reallocate part or all approved funds, according to the evolving circumstances, to achieve the smoothest reduction of consumption and phase-down of Annex F substances specified in Appendix 1-A, in accordance with the following considerations:

(a) Reallocations categorized as major changes must be documented in advance, either in a Tranche Implementation Plan as foreseen in subparagraph 5(d) above, or as a revision to an existing Tranche Implementation Plan to be submitted 12 weeks prior to any meeting of the Executive Committee, for its approval. Major changes would relate to:

(i) Issues potentially concerning the rules and policies of the Multilateral Fund;

(ii) Changes that would modify any clause of this Agreement;

(iii) Changes in the annual levels of funding allocated to the individual bilateral or implementing agencies for the different tranches;

(iv) Provision of funding for activities not included in the current endorsed Tranche Implementation Plan, or removal of an activity in the Tranche Implementation Plan, with a cost greater than 30 per cent of the total cost of the last approved tranche;

(v) Changes in alternative technologies, on the understanding that any submission for such a request would identify the associated incremental costs, the potential impact on the climate, and any differences in CO_2-eq tonnes to be phased down if applicable, as well as confirm that the Country agrees that potential savings related to the change of technology would accordingly decrease the overall funding level under this Agreement;

(b) Reallocations not categorized as major changes may be incorporated into the approved Tranche Implementation Plan, under implementation at the time, and reported to the Executive Committee in the subsequent Tranche Implementation Report;

(c) Any enterprise included in the Plan that would be found to be ineligible under the policies of the Multilateral Fund (i.e., due to foreign ownership or establishment after the applicable

cut off date) would not receive financial assistance. This information would be reported as part of the Tranche Implementation Plan; and

(d) Any remaining funds held by the bilateral or implementing agencies or the Country under the Plan will be returned to the Multilateral Fund upon completion of the last tranche foreseen under this Agreement.

8. Specific attention will be paid to the execution of activities in the refrigeration servicing sector included in the Plan, in particular that the Country may use the flexibility available under this Agreement to address specific needs that might arise during project implementation.

Bilateral and implementing agencies

9. The Country agrees to assume overall responsibility for the management and implementation of this Agreement and of all activities undertaken by it or on its behalf to fulfil the obligations under this Agreement. UNDP has agreed to be the lead implementing agency (the "Lead IA") and UNIDO and the Government of the United Kingdom of Great Britain and Northern Ireland have agreed to be the cooperating implementing agencies (the "Cooperating IAs") under the lead of the Lead IA in respect of the Country's activities under this Agreement. The Country agrees to evaluations, which might be carried out under the evaluation work programme of the Multilateral Fund or the evaluation programme of the Lead IA and/or Cooperating IAs taking part in this Agreement.

10. The Lead IA will be responsible for ensuring coordinated planning, implementation and reporting of all activities under this Agreement, including but not limited to the independent verification as per subparagraph 5(b). The Cooperating IAs will support the Lead IA by implementing the Plan under the overall coordination of the Lead IA. The roles of the Lead IA and Cooperating IAs are contained in Appendix 6-A and Appendix 6-B, respectively. The Executive Committee agrees, in principle, to provide the Lead IA and the Cooperating IAs with the fees set out in rows 2.2, 2.4 and 2.6 of Appendix 2-A.

Non-compliance with the Targets in the Agreement

11. Should the Country, for any reason, not meet the Targets for the elimination of Annex F substances set out in row 1.2 of Appendix 2-A or otherwise does not comply with this Agreement, then the Country agrees that it will not be entitled to the Funding in accordance with the Funding Approval Schedule. At the discretion of the Executive Committee, funding will be reinstated according to a revised Funding Approval Schedule determined by the Executive Committee after the Country has demonstrated that it has satisfied all its obligations that were due to be met prior to receipt of the next tranche of funding under the Funding Approval Schedule. The Country acknowledges that the Executive Committee may reduce the amount of the Funding by the amount set out in Appendix 7-A ("Reductions in Funding for Failure to Comply") in respect of each CO_2-eq kg of reductions in consumption not achieved in any one year. The Executive Committee will discuss each specific case in which the Country did not comply with this Agreement and take related decisions. Once decisions are taken, the specific case of non-compliance with this Agreement will not be an impediment for the provision of funding for future tranches as per paragraph 5 above.

12. The Funding of this Agreement will not be modified on the basis of any future Executive Committee decisions that may affect the funding of any other consumption sector projects or any other related activities in the Country.

13. The Country will comply with any reasonable request of the Executive Committee, the Lead IA and the Cooperating IAs to facilitate implementation of this Agreement. In particular, it will provide the Lead IA and the Cooperating IAs with access to the information necessary to verify compliance with this Agreement.

Date of completion

14. The completion of the Plan and the associated Agreement will take place at the end of the year following the last year for which a maximum allowable total consumption level has been specified in Appendix 2-A. Should at that time there still be activities that are outstanding, and which were foreseen in the last Tranche Implementation Plan and its subsequent revisions as per subparagraph 5(d) and paragraph 7, the completion of the Plan will be delayed until the end of the year following the implementation of the remaining activities. The reporting requirements as per subparagraphs 1(a), 1(b), and 1(d) of Appendix 4-A will continue until the time of the completion of the Plan unless otherwise specified by the Executive Committee.

Validity

15. All conditions set out in this Agreement are undertaken solely within the context of the Montreal Protocol and as specified in this Agreement. All terms used in this Agreement have the meaning ascribed to them in the Montreal Protocol unless otherwise defined herein.

16. This Agreement may be modified or terminated only by mutual written agreement of the Country and the Executive Committee of the Multilateral Fund.

APPENDICES

APPENDIX 1-A: THE SUBSTANCES

Substances	**Starting point for aggregate reductions in consumption (CO_2-eq tonnes)**
HFCs	To be determined (TBD)

APPENDIX 2-A: THE TARGETS, AND FUNDING

Row	Particulars		2026	2027	2028	2029	2030	2031	2032	Total
1.1	Montreal Protocol reduction schedule of Annex F substances	%	freeze	freeze	freeze	10	10	10	10	n/a
		CO_2-eq tonnes	72,897,680	72,897,680	72,897,680	65,607,912	65,607,912	65,607,912	65,607,912	n/a
1.2	Maximum allowable total consumption of Annex F substances	Reduction in %	0.0	0.0	0.0	10.0	10.0	10.0	12.0	n/a
		CO_2-eq tonnes	72,897,680	72,897,680	72,897,680	65,607,912	65,607,912	65,607,912	64,149,958	n/a
2.1	Lead IA (UNDP) agreed funding (US $)		6,088,040	0	7,864,178	0	6,285,766	0	0	20,237,984
2.2	Support costs for Lead IA (US $)		426,163	0	550,492	0	440,004	0	0	1,416,659
2.3	Cooperating IA (UNIDO) agreed funding (US $)		1,566,337	0	1,236,622	0	1,049,925	0	0	3,852,884
2.4	Support costs for Cooperating IA (US $)		109,644	0	86,563	0	73,495	0	0	269,702
2.5	Cooperating IA (UK) agreed funding (US $)		1,080,607	0	1,080,607	0	240,137	0	0	2,401,351
2.6	Support costs for Cooperating IA (US $)		123,367	0	123,367	0	27,415	0	0	274,149
3.1	Total agreed funding (US $)		8,734,984	0	10,181,407	0	7,575,828	0	0	26,492,219
3.2	Total support costs (US $)		659,174	0	760,422	0	540,914	0	0	1,960,510
3.3	Total agreed costs (US $)		9,394,158	0	10,941,829	0	8,116,742	0	0	28,452,729
4.1.1	Deductions of HFCs agreed under this Agreement (CO_2-eq tonnes)									7,289,768
4.1.2	Deductions of HFCs from previously approved projects (CO_2-eq tonnes)									0
4.1.3	Remaining eligible consumption for HFCs (CO_2-eq tonnes)									TBD

APPENDIX 3-A: FUNDING APPROVAL SCHEDULE

1. Funding for the future tranches will be considered for approval at the second meeting of the year specified in Appendix 2-A.

APPENDIX 4-A: FORMAT OF THE TRANCHE IMPLEMENTATION REPORTS AND PLANS

1. The submission of the Tranche Implementation Report and Plans for each tranche request will consist of four parts:

(a) A narrative report, with data provided by tranche, describing the progress achieved since the previous report, reflecting the situation of the Country in regard to phase-down of Annex F substances, how the different activities contribute to it, and how they relate to each other, including, where applicable, activities related to energy efficiency approved in the context of HFC phase-down pursuant to decision 91/65. The report should include the amount of Annex F substances consumption reduced as a direct result of the implementation of activities, by substance, the alternative technology used and the related phase in of alternatives, to allow the Secretariat to inform the Executive Committee on the resulting change in climate relevant emissions. The report should also include quantitative information on the activities implemented and further highlight the successes, experiences, and challenges related to the different activities included in the Plan, reflecting any changes in the circumstances in the Country, and providing other relevant information. The report should also include information on and justification for any changes vis-à-vis the previously submitted Tranche Implementation Plan(s), such as delays, use of flexibility for the reallocation of funds during implementation of a tranche as provided for in paragraph 7 of this Agreement, or other changes;

(b) An independent verification report on the Plan's results and the consumption of Annex F substances, as per subparagraph 5(b) of the Agreement. If not decided otherwise by the Executive Committee, such a verification of consumption data must be provided with each tranche request, covering all relevant years for which a verification report has not yet been acknowledged by the Committee, as specified in subparagraph 5(a) of the Agreement;

(c) A written description of the activities to be undertaken during the period covered by the requested tranche including quantitative information, highlighting implementation milestones, the time of completion and the interdependence of the activities, and taking into account experiences made and progress achieved in the implementation of earlier tranches; the data in the Plan will be provided by calendar year. The description should include a reference to the overall Plan and progress achieved, as well as any possible changes to the overall Plan that are foreseen. The description should also specify and explain in detail such changes to the overall Plan. This description of future activities can be submitted as a part of the same document as the narrative report under subparagraph 1(a) above; and

(d) An Executive Summary of about five paragraphs, summarizing the information contained in subparagraphs 1(a) to 1(c) above.

APPENDIX 5-A: MONITORING INSTITUTIONS AND ROLES

1. The Ministry of the Environment and Climate Change (MMA) is responsible for the overall coordination of activities to be undertaken in the Plan and acts as the national ozone unit (NOU). The

Brazilian Institute of the Environment and Natural Renewable Resources (IBAMA) is the enforcement institution linked to the MMA, responsible for carrying out national policies and legislation regarding HFC control. The NOU (under the MMA) monitors at the managerial level all HFC consumption. IBAMA controls HFC consumption (import and export) at end-user level through the licensing system. The Lead IA and Cooperating IAs will be responsible for implementing and monitoring all activities.

2. The Government has offered and intends to offer continuity of activities and endorsement for the projects over the next years as specified in the "Regulatory actions" component and the list of activities of the institutional strengthening project. This will guarantee the success of any activity approved for the Country.

3. Close monitoring of all activities and coordination between stakeholders is an essential element of the Plan and is key to reach compliance. There will be regular coordination meetings with industry stakeholders, HFC importers, relevant Government stakeholders, various industrial associations, and all sectors involved, in order to enact the necessary agreements and measures to carry out the investment and non-investment activities on time and in a coordinated manner. In the manufacturing sector, the implementation process and the achievement of the phase-down will be monitored through site visits at enterprise level. Yearly monitoring will be carried out through the HFC licensing and quota system. Verification site visits will be undertaken by independent international experts and a verifier.

4. The MMA will be responsible for the sustainability of consumption reduction targets achieved through this Agreement.

APPENDIX 6-A: ROLE OF THE LEAD IMPLEMENTING AGENCY

1. The Lead IA will be responsible for a range of activities, including at least the following:

(a) Ensuring performance and financial verification in accordance with this Agreement and with its specific internal procedures and requirements as set out in the Country's Plan;

(b) Assisting the Country in the preparation of the Tranche Implementation Reports and Plans as per Appendix 4-A;

(c) Providing independent verification to the Executive Committee that the Targets have been met and associated tranche activities have been completed as indicated in the Tranche Implementation Plan, consistent with Appendix 4-A;

(d) Ensuring that the experiences and progress are reflected in the updates to the overall Plan and in the future Tranche Implementation Plans, consistent with subparagraph 1(c) of Appendix 4-A;

(e) Fulfilling the reporting requirements of the Tranche Implementation Reports and Plans and of the overall Plan as specified in Appendix 4-A for submission to the Executive Committee including the activities implemented by the Cooperating IAs;

(f) In the event that the last funding tranche is requested one or more years prior to the last year for which a consumption target had been established, annual Tranche Implementation Reports and, where applicable, verification reports on the current stage of the Plan should be submitted until all activities foreseen had been completed and HFC consumption targets had been met;

(g) Ensuring that appropriate independent technical experts carry out the technical reviews;

(h) Carrying out the required supervision missions;

(i) Ensuring the presence of an operating mechanism to allow for an effective and transparent implementation of the Tranche Implementation Plan and accurate data reporting;

(j) Coordinating the activities of the Cooperating IAs and ensuring the appropriate sequence of activities;

(k) In case of reductions in funding for failure to comply in accordance with paragraph 11 of the Agreement, to determine, in consultation with the Country and the Cooperating IAs, the allocation of the reductions to the different budget items and to the funding of the Lead IA and each Cooperating IA;

(l) Ensuring that disbursements made to the Country are based on the use of the indicators;

(m) Providing assistance with the policy, management and technical support when required;

(n) Reaching consensus with the Cooperating IAs on any planning, coordination and reporting arrangements required to facilitate the implementation of the Plan; and

(o) Timely releasing funds to the Country/participating enterprises for completing the activities related to the project.

2. After consultation with the Country and taking into account any views expressed, the Lead IA will select and mandate an independent entity to carry out the verification of the Plan's results and of the consumption of Annex F substances mentioned in Appendix 1-A, as per subparagraph 5(b) of the Agreement and subparagraph 1(b) of Appendix 4-A.

APPENDIX 6-B: ROLE OF THE COOPERATING IMPLEMENTING AGENCIES

1. The Cooperating IAs will be responsible for a range of activities. These activities are specified in the Plan, including at least the following:

(a) Providing assistance for policy development when required;

(b) Assisting the Country in the implementation and assessment of the activities funded by the Cooperating IAs, and referring to the Lead IA to ensure a coordinated sequence of activities;

(c) Providing reports to the Lead IA on these activities, for inclusion in the consolidated reports as per Appendix 4-A; and

(d) Reaching consensus with the Lead IA on any planning, coordination and reporting arrangements required to facilitate the implementation of the Plan.

APPENDIX 7-A: REDUCTIONS IN FUNDING FOR FAILURE TO COMPLY WITH THE TARGETS IN THE AGREEMENT

1. In accordance with paragraph 11 of the Agreement, the amount of funding provided may be reduced by US $7.27 per CO_2-eq tonne of consumption beyond the level defined in row 1.2 of Appendix 2-A for each year in which the Target specified in row 1.2 of Appendix 2-A has not been met, on the understanding that the maximum funding reduction would not exceed the funding level of the tranche being requested.

Additional measures might be considered in cases where non-compliance extends for two consecutive years. Where the Country has failed to comply with the Agreement due to illegal trade, the reduction in funding would not be applied if the illegally traded controlled substances are seized and subsequently confiscated, destroyed, exported, or returned to the country of origin.

Annex III

SIMULTANEOUS IMPLEMENTATION OF THE HCFC PHASE-OUT MANAGEMENT PLAN AND THE KIGALI HFC IMPLEMENTATION PLAN IN BRAZIL

Sector/ Component	HPMP – stage III		KIP – stage I		HPMP+KIP combined cost (US $)
	Main focus/activities	Cost (US $)	Main focus/activities	Cost (US $)	
Regulatory component	Review norms for HCFC import quotas; develop control mechanisms for the use of HCFCs in servicing, including inter alia equipment labelling by manufacture date and regulations on the manufacturing of HCFC-based equipment; develop guidelines for the correct recovery and disposal of unusable or obsolete refrigerants from old transport trucks; develop a standard on the testing and safe handling of cleaning agents alternative to HCFC-141b for flushing RAC circuits; and support for the adoption of standards for the safe handling of NH_3 in industrial refrigeration	200,000	Promote the adoption of mandatory practices and technical qualification, particularly in the servicing sector, contributing to leak containment, maintenance and end-of-life management; enable the safe use of flammable refrigerants through harmonization with international standards and the updating of national technical requirements; and stimulate technological conversions to low-GWP alternatives by creating a regulatory environment conducive to innovation and a sustainable transition; strengthen data recording and reporting for sector use and blends	707,322	907,322
Strengthening of the integrated management system for refrigerant reclaim, recovery and recycling (RRR)	**RRR**: Strengthen the 6 operating reclaim centres, establish 3 additional reclaim centres and 3 recycling and reclaim support centres; pilot destruction, network of collection points, refrigerant reclaim equipment prototype	3,779,546	Support to 200 MAC workshops with equipment for the recovery, recycling and recharge of refrigerant, refrigerant analysers, and related tools, and contingency	1,901,540	5,681,086
	Flushing and solvent: support the replacement of HCFC-141b as solvent; technical support to RAC servicing workshops; module on flushing practices and training of 66 instructors and 5.000 technicians	1,037,022			1,037,022
		550,440			550,440
	Strengthening inspection: Strengthen the environmental control bodies at the federal, state and municipal levels through training courses and procurement of refrigerant identifiers/analyzers	170,000			170,000
	Awareness and outreach: Five-year communication plan and marketing campaign, development of related technical materials	650,000			650,000

Sector/ Component	HPMP – stage III		KIP – stage I		HPMP+KIP combined cost (US $)
	Main focus/activities	Cost (US $)	Main focus/activities	Cost (US $)	
Technical assistance and demonstrations for the AC sectors	**Demonstration project on chillers**: Support the replacement of at least 10 HCFC-22-based chillers installed in commercial (shopping malls, hospitals, hotels, supermarkets) and industrial facilities with chillers based on energy-efficient alternatives with zero ODP and low GWP	5,039,800	**Demonstration project on sustainable AC using R-290 s:** Procurement, installation and monitoring of 160 split AC units with HC-290 at 8 end users to evaluate equipment safety, technical and operational feasibility, data collection, analysis, and dissemination	743,700	5,783,500
	Demonstration project on AC equipment: Support the replacement of at least 50 HCFC-22-based AC units of different capacities in commercial buildings by equipment based on energy-efficient, low-GWP alternatives	989,700	**Demonstration project for the installation of VRF AC system using CO_2:** Procurement, installation and monitoring of CO_2-based and HFC32 based VRF systems in buildings situated in a different climatic region; and evaluation of the feasibility of this technology for future commercial and institutional applications	650,600	1,640,300
	Feasibility study for the implementation of a district cooling system: Carry out a feasibility study for the implementation of district cooling systems based on zero-ODP and low- or medium-GWP technologies or energy-efficient absorption systems, and organize seminars and meetings to disseminate study results	104,500	**Study and assessment of cooling systems for data centres**: Carry out a feasibility study for the use of low-GWP refrigerants in AC equipment for data centre by evaluating equipment, refrigerants, costs, potential applications, limitations, energy performance, safety, technical and operational feasibility concerning the establishment of policies for the use of low-GWP refrigerants	250,002	354,502
	Awareness and outreach: Five-year communication plan and marketing campaign, preparation of technical materials; organization of workshops and participation in sectoral events and trade shows to disseminate the results of the demonstration projects to end users and RAC sector stakeholders	275,000			275,000
			Pilot project for the development of AC based on HC-290: Preparation of a feasibility study for the use of low-GWP refrigerants in MAC systems and development of an AC unit charged with HC-290 for demonstration purposes	446,056	446,056

Sector/ Component	HPMP – stage III		KIP – stage I		HPMP+KIP combined cost (US $)
	Main focus/activities	Cost (US $)	Main focus/activities	Cost (US $)	
Capacity building in the residential AC and industrial and commercial refrigeration sectors	**Universities:** In cooperation with 2 technical universities, develop a practical training programme and educational materials, install demonstration AC and refrigeration units and procure tool kits for training, and provide training to 8 university instructors and 400 mechanical engineering students on zero-ODP/low-GWP technologies, best servicing practices, leak containment, and the safe handling of flammable refrigerants	990,000			990,000
	Vocational training: In cooperation with a training institution, develop a practical training programme and educational materials, adapt the practice laboratory with the provision of an NH_3-based refrigeration system, and provide theoretical and practical training for 4 instructors and 600 technicians in the industrial refrigeration subsector on the safe handling of NH_3-based systems	1,263,020			1,263,020
Capacity building in the commercial refrigeration and room AC servicing sectors (technician training, certification and awareness)	Curriculum development for a technician QCR scheme and development of curricula and teaching material (Room AC)	80,000	Curriculum development for a technician QCR scheme and development of curricula and teaching material (Commercial refrigeration)	80,000	1,821,000
	Develop and implement a QCR pilot project for 80 RAC technicians (Room AC)	240,000	Develop and implement a QCR pilot project for 160 RAC technicians (Commercial refrigeration)	446,000	
	Provide demonstration equipment and tool kits for the QCR pilot project (Room AC)	600,000	Provide demonstration equipment and tool kits for the QCR pilot project (Commercial refrigeration)	375,000	
	Updating the best practice handbooks on HCFC containment and provide training on best practices for AC and commercial refrigeration systems for 66 instructors and 5,000 RAC technicians	2,216,760			2,871,322
	Provide demonstration equipment (AC and commercial refrigeration - HCFC-22 containment courses), sealed system design components, among others, and tool kits	654,562			
	Updating the best practice handbooks on CO_2 and HC in commercial refrigeration systems, updating the best practices handbook on alternative, low-GWP flammable refrigerants in AC systems, and providing	4,532,250	Updating the best practice handbooks on CO_2 and HC in commercial refrigeration systems, ,and on alternative, low-GWP flammable refrigerants in AC systems, and providing training on best practices in	751,000	5,283,250

Sector/ Component	HPMP – stage III		KIP – stage I		HPMP+KIP combined cost (US $)
	Main focus/activities	Cost (US $)	Main focus/activities	Cost (US $)	
	training on best practices in the safe and efficient use of zero-ODP, low-GWP refrigerants in small AC units and in commercial refrigeration systems to 75 instructors and 8,000 RAC technicians (5,000 technicians trained on flammable refrigerants for AC and 3,000 on CO_2/HC in commercial refrigeration)		the safe and efficient use of zero-ODP, low-GWP refrigerants in small AC units and in commercial refrigeration systems to 1,100 RAC technicians (770 technicians trained on flammable refrigerants for AC and 330 on CO_2/HC in commercial refrigeration); and carry out refresher train-the-trainer courses		
	Provide demonstration equipment (AC units) and training tool kits for 5 training centres and establish 2 additional centres to promote the safe and efficient use of CO_2 and HC in commercial refrigeration cascade systems, including tool kits	1,800,000	Replacement and repair of tools and demonstration equipment provided under the HPMP	75,000	1,875,000
	Build stakeholder awareness by disseminating information on HPMP activities related to best practices and zero-ODP, low-GWP refrigerants	500,000	Awareness and outreach with special focus on end users to disseminate information on the environmental and economic benefits of energy-efficient, low-GWP refrigerants	320,000	820,000
	Local monitoring and management	800,000	Local monitoring and management	240,000	1,040,000
	Contingencies	358,254	Contingencies	114,350	472,604
Capacity building in the MAC servicing sector			Training of 4,000 technicians in in handling HFC-134a during the installation and maintenance of MAC systems to reduce refrigerant emissions and consumption; and development of a QCR model for the MAC sector; Development of training materials and training of 10 MAC instructors; Procurement of tools for 10 MAC training institutes; and Technical assistance	3,653,401	3,653,401
Technology demonstration commercial refrigeration	**Demonstration project to install indirect-expansion refrigeration systems with modular air-condensing chillers based on low-GWP and zero-ODP refrigerants in 8 supermarkets:** Demonstrate, under real operating conditions, the technical and energy feasibility of this system configuration as a viable alternative to the direct-expansion systems traditionally used in the retail sector	2,805,000	**Demonstration project for the use of NH_3 in supermarket refrigeration installations:** Develop, install, and evaluate the application of modular chillers using low-charge NH_3 in commercial refrigeration systems	1,983,000	5,755,833
			Demonstration project for reducing HFC leaks and energy consumption in supermarkets through digitalization of refrigeration systems: Demonstrate the technical/economic feasibility and	967,833	

Sector/ Component	HPMP – stage III		KIP – stage I		HPMP+KIP combined cost (US $)
	Main focus/activities	Cost (US $)	Main focus/activities	Cost (US $)	
			support the dissemination of digital tools for monitoring and controlling HFC leaks and increasing the energy efficiency of refrigeration systems at 6 supermarkets		
Technology demonstrations in the industrial refrigeration sector	**Demonstration project at 3 industrial facilities to replace HCFC-22 refrigeration systems with low-charge NH_3 or HFO in air-condensing chillers**: Demonstrate the technical, economic and environmental feasibility of alternatives to HCFC-22	2,068,000	**Technical assistance and demonstration project for reducing HFC consumption in the industrial refrigeration and heat pump sectors:** (1) Development, installation, demonstration and evaluation of an industrial low-charge NH_3 system and heat pump application for waste heat recovery for reducing HFCs; and technical assistance to the industrial refrigeration sector; (2) technical assistance; and (3) training	2,873,890	4,941,890
Manufacturing sectors			**Light commercial refrigeration**: Sector plan to convert 116 enterprises to R-290, including specialized technical assistance, conversion of production lines, training for the safe use of flammable refrigerants, adaptation of manufacturing facilities, communication, mobilization and information dissemination	7,425,000	7,425,000
			Industrial refrigeration: Conversion of selected product lines at 3 enterprises and technology demonstration at end users	691,592	691,592
PMU	Coordination and monitoring (Lead IA)	1,400,000	Coordination and monitoring (Lead IA)	1,509,631	2,909,631
	Coordination and monitoring (Cooperating IA)	712,602	Coordination and monitoring (Cooperating IA)	287,402	1,000,004
Total		**33,816,456**		**26,492,319**	**60,308,675**
Percentage of total (%)		**56**		**44**	**100**