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COMITÉ EJECUTIVO DEL FONDO MULTILATERAL
PARA LA APLICACIÓN DEL
PROTOCOLO DE MONTREAL
Nonagésima octava reunión
Montreal, 22-26 de junio de 2026
Punto 8 c) del orden del día provisional[1]

PROGRAMA DE TRABAJO DEL PNUD PARA 2026

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

OBSERVACIONES Y RECOMENDACIÓN DE LA SECRETARÍA DEL FONDO

1. El PNUD solicita al Comité Ejecutivo que apruebe el monto de USD 2.156.209, más USD 155.135 por concepto de gastos de apoyo al organismo, para su programa de trabajo para 2026 indicado en el cuadro 1. La presentación se adjunta a este documento.

Cuadro 1: Programa de trabajo del PNUD para 2026

País	Actividad/Proyecto	Monto solicitado (USD)	Monto recomendado (USD)
SECCIÓN A: ACTIVIDADES CUYA APROBACIÓN GENERAL SE RECOMIENDA			
A1: Renovación de proyectos de fortalecimiento institucional			
Chile	Renovación del proyecto de fortalecimiento institucional (fase XVI)	494.283	494.283
Líbano	Renovación del proyecto de fortalecimiento institucional (fase XIV)	410.926	410.926
	Subtotal A1	905.209	905.209
	Gastos de apoyo al organismo	63.365	63.365
	Total A1	968.574	968.574
A2: Preparación de proyectos para planes de aplicación de la Enmienda de Kigali relativa a los HFC (PAK)			
Haití	Preparación de un PAK (etapa I)	130.000	130.000
India	Preparación de un PAK (etapa I)	450.000	450.000
India	Preparación de proyectos de inversión del PAK en el sector de la fabricación de equipos de refrigeración para Ultrakool y Birla Aircon Limited	60.000	60.000
	Subtotal A2	640.000	640.000
	Gastos de apoyo al organismo	44.800	44.800
	Total A2	684.800	684.800
A3: Asistencia técnica para la preparación de un informe de verificación sobre el consumo de HFC y/o HCFC			
Costa Rica	Informe de verificación para la etapa II del PGEH y la etapa I del PAK	45.000	45.000
El Salvador	Informe de verificación para la etapa I del PAK	30.000	30.000
Georgia	Informe de verificación para la etapa II del PGEH y la etapa I del PAK	45.000	45.000
Ghana	Informe de verificación para la etapa I del PAK	30.000	30.000
Jamaica	Informe de verificación para la etapa II del PGEH	30.000	30.000
Uruguay	Informe de verificación para la etapa I del PAK	30.000	30.000
	Subtotal A3	210.000	210.000
	Gastos de apoyo al organismo	18.900	18.900
	Total A3	228.900	228.900
A4: Preparación de un proyecto piloto destinado a mantener y/o mejorar la eficiencia energética de equipos y tecnologías sustitutivas en el contexto de la reducción de los HFC conforme a la decisión 91/65[2]			
Angola	A4.1 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración industrial	30.000	30.000
Barbados	A4.2 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial	30.000	30.000
Belice	A4.3 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración	30.000	30.000
Camboya	A4.4 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial e industrial	30.000	30.000
Etiopía	A4.5 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial	30.000	30.000

[2] En adelante, preparación de un proyecto piloto destinado a mantener y/o mejorar la eficiencia energética.

País	Actividad/Proyecto	Monto solicitado (USD)	Monto recomendado (USD)
Guinea-Bissau	A4.6 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial	30.000	30.000
India	A4.7 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial	50.000	50.000
Kenya	A4.8 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial	30.000	30.000
San Vicente y las Granadinas	A4.9 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial	30.000	30.000
Senegal	A4.10 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial	30.000	30.000
	Subtotal A4	320.000	320.000
	Gastos de apoyo al organismo	22.400	22.400
	Total A4	342.400	342.400
A5: Preparación de un proyecto para mejorar la eficiencia energética en el contexto de la reducción de los HFC en el sector de la fabricación de equipos de refrigeración y aire acondicionado conforme a la decisión 94/60			
Brasil	Preparación de un proyecto para mejorar la eficiencia energética en las empresas de fabricación de equipos de refrigeración y aire acondicionado en el contexto de la reducción de los HFC	81.000	81.000
	Subtotal A5	81.000	81.000
	Gastos de apoyo al organismo	5.670	5.670
	Total A5	86.670	86.670
	Total para A1, A2, A3, A4, A5	2.156.209	2.156.209
	Gastos de apoyo para A1, A2, A3, A4, A5	155.135	155.135
	Total general	2.311.344	2.311.344

SECCIÓN A: ACTIVIDADES CUYA APROBACIÓN GENERAL SE RECOMIENDA

A1: Renovación de proyectos de fortalecimiento institucional

Descripción de los proyectos

2. El PNUD ha presentado solicitudes para la renovación de proyectos de fortalecimiento institucional para los países que se indican en la sección A1 del cuadro 1. Los proyectos se describen en el anexo I del presente documento.

Observaciones de la Secretaría

3. La Secretaría examinó las solicitudes de renovación de dos proyectos de fortalecimiento institucional presentadas por el PNUD en nombre de los gobiernos interesados, a la luz de las directrices[3] y de las decisiones pertinentes relativas a la admisibilidad y los niveles de financiamiento. Las solicitudes se cotejaron con los planes de trabajo de fortalecimiento institucional originales correspondientes a la fase anterior, los datos del programa país y los datos del artículo 7, el informe de ejecución más reciente del plan de gestión para la eliminación de los HCFC (PGEH), el informe sobre la marcha de las actividades presentado por el organismo y decisiones pertinentes de las Reuniones de las Partes. Se observó que ambos

[3] Decisión 91/63: b) aprobar el formato revisado para los informes finales y las solicitudes de prórroga del financiamiento de fortalecimiento institucional y los indicadores de desempeño correspondientes; y c) solicitar a los países del artículo 5, por intermedio de los organismos bilaterales y de ejecución, utilizar el formato revisado a que se refiere el subpárrafo b) anterior para toda solicitud de renovación de proyectos de fortalecimiento institucional a partir de la primera reunión del Comité Ejecutivo en 2023.

países habían presentado los datos de su programa país para 2025, cumplían las metas de control del Protocolo de Montreal y habían notificado un consumo anual de HCFC y HFC que no excedía el consumo máximo anual permitido indicado en sus Acuerdos con el Comité Ejecutivo en el marco de los PGEH y PAK. Además, todas las solicitudes presentadas incluían una evaluación de los indicadores de desempeño, del riesgo y la sostenibilidad de los proyectos y de la consecución de los objetivos de fortalecimiento institucional, de conformidad con la decisión 91/63 b).

Recomendación de la Secretaría

4. La Secretaría recomienda la aprobación general de las solicitudes de renovación de los proyectos de fortalecimiento institucional para Chile y el Líbano, con los niveles de financiamiento que se indican en la sección A1 del cuadro 1 del presente documento. El Comité Ejecutivo podría estimar oportuno remitir a los respectivos Gobiernos las observaciones formuladas en el anexo II al presente documento.

A2: Preparación de proyectos para planes de aplicación de la Enmienda de Kigali relativa a los HFC

Descripción de los proyectos

5. El PNUD presentó solicitudes para la preparación de la etapa I del PAK para dos países del artículo 5; y presentó una solicitud para la preparación de dos proyectos de inversión en el sector de la fabricación de equipos de refrigeración para un país del artículo 5, en su calidad de organismo de ejecución designado, como se muestra en la sección A2 del cuadro 1. El PNUD, en su calidad de organismo de ejecución designado para la India y Haití, ha facilitado una descripción de las actividades necesarias para la preparación de la etapa I del PAK y para la preparación de proyectos de inversión para la India, así como los costos correspondientes a cada actividad, utilizando el formato de solicitud de preparación de proyectos para un PAK.

Observaciones de la Secretaría

6. Al examinar las solicitudes de preparación de un PAK (etapa I) para Haití y la India:

a) La Secretaría tuvo en cuenta las directrices para la preparación de los PAK que figuran en la decisión 87/50, las actividades propuestas para la preparación de los proyectos y su conexión con las actividades de apoyo y otros proyectos relacionados con los HFC en los países pertinentes. La presentación para Haití incluía datos sobre el consumo de HFC y mezclas de HFC de 2023 a 2025, y la presentación para la India incluía datos sobre el consumo de HFC y mezclas de HFC de 2022 a 2024, con los datos para 2025 aún en fase de recopilación. Ambas presentaciones incluían, en las actividades de preparación del proyecto, una encuesta a nivel nacional y la recopilación de datos sobre el consumo de HFC, análisis del uso de HFC y sus alternativas, un examen de las iniciativas, políticas y normativas nacionales pertinentes relacionadas con la reducción de los HFC, una evaluación de las necesidades en el sector de servicio y mantenimiento de equipos de refrigeración y aire acondicionado, la preparación de planes de comunicación y actividades de sensibilización, y el desarrollo de una estrategia general de reducción de los HFC. La presentación para la India también incluía actividades de preparación de un plan para el sector de la fabricación de equipos de refrigeración y aire acondicionado. En relación con el consumo por sectores y los datos de las empresas del sector manufacturero de la India, el PNUD señaló que, por el momento, no se dispone de dicha información debido a la complejidad que entraña el gran número de sectores, sustancias y usuarios finales. Esta información se finalizará durante la preparación del proyecto.

b) La Secretaría señaló que ambos países habían ratificado la Enmienda de Kigali[4], que los Gobiernos habían presentado cartas de respaldo para apoyar la preparación del proyecto, y que el financiamiento solicitado se ajusta a la decisión 87/50 c) en el caso de Haití, y a la decisión 87/50 c) y f) en el caso de la India. El PNUD indicó que, en el caso de Haití y la India, la preparación de los proyectos para las estrategias generales de los PAK se basaría en las actividades ejecutadas en el marco de las actividades de apoyo a la reducción de los HFC.

7. En cuanto a la preparación de proyectos de inversión de los PAK en el sector de la fabricación de equipos de refrigeración para Ultrakool y Birla Aircon Limited en la India, la Secretaría señaló que:

a) La preparación para los proyectos de inversión de los PAK en el sector de la fabricación de equipos de refrigeración incluiría la conversión en dos empresas de la siguiente manera: conversión de la planta de fabricación, que comprende congeladores de aire forzado, cámaras frigoríficas y enfriadores de proceso, de R-404A y R-407C a propano (R-290) y demostración de mejora de la eficiencia energética en Ultrakool; y conversión de las instalaciones de fabricación que incluyen vitrinas, dispensadores de agua, congeladores con ruedas, prototipos y unidades de condensación, pasando de HFC-134a a R-290, así como la demostración de mejora de la eficiencia energética en Birla Aircon Limited. Las actividades de preparación de ambos proyectos incluirían la recopilación de datos a nivel empresarial, consultas con las partes interesadas y expertos, el diseño y la validación de los proyectos, consultas nacionales y la elaboración de las propuestas finales.

b) Los datos sobre el consumo de HFC de las dos empresas no se incluyeron en la presentación. El PNUD señaló que los datos sobre el consumo de HFC se recopilarían como parte de la preparación de los proyectos propuestos. El financiamiento solicitado se ajusta a la decisión 87/50 f) v) sobre la preparación de proyectos de inversión y planes sectoriales de los PAK.

Recomendación de la Secretaría

8. La Secretaría recomienda la aprobación general de la preparación de proyectos para la etapa I de los planes de aplicación de la Enmienda de Kigali relativa a los HFC (PAK) de Haití y la India, así como de la preparación de dos proyectos de inversión en el sector de fabricación de equipos de refrigeración para Ultrakool y Birla Aircon Limited, en la India, con los niveles de financiamiento que se indican en la sección A2 del cuadro 1.

A3: Asistencia técnica para la preparación de un informe de verificación sobre el consumo de HFC y/o HCFC

Descripción de los proyectos

9. De conformidad con la decisión 61/46 c)[5], la Secretaría seleccionó una muestra de un país de bajo consumo acogido al artículo 5 a efectos de verificar el cumplimiento de su Acuerdo relativo al plan de gestión para la eliminación de los HCFC (PGEH). El PNUD, en su calidad de organismo de ejecución principal/designado, solicita financiamiento para la verificación de la etapa II del PGEH de Jamaica, como se indica en la sección A3 del cuadro 1.

[4] Haití ratificó la Enmienda de Kigali el 8 de abril de 2026; la India ratificó la Enmienda de Kigali el 27 de septiembre de 2021.

[5] Se solicitó a la Secretaría que proporcionara, en la primera reunión de cada año, una lista que representara el 20 % de los países con un nivel básico de consumo de HCFC de hasta 360 toneladas métricas y con un PGEH aprobado, a fin de aprobar financiamiento para verificar el cumplimiento por parte de ese país del acuerdo relativo al PGEH para ese año.

10. De conformidad con la decisión 96/22 a) i)[6], la Secretaría preparó la lista de países para la verificación del cumplimiento de sus Acuerdos relativos a los PAK. El PNUD, en su calidad de organismo de ejecución principal, solicita financiamiento para la verificación de la etapa I de los PAK de El Salvador, Ghana y Uruguay, como se muestra en la sección A3 del cuadro 1.

11. De conformidad con la decisión 96/22 b)[7], el PNUD, en su calidad de organismo de ejecución principal/designado, también solicita financiamiento para la verificación combinada de la etapa I de los PAK y la etapa II de los PGEH de Costa Rica y Georgia, como se indica en la sección A3 del cuadro 1.

Observaciones de la Secretaría

12. La Secretaría señaló que las solicitudes de financiamiento eran coherentes con lo establecido en las decisiones pertinentes, así como con los fondos aprobados para verificaciones similares en reuniones anteriores, y señaló además que los informes de verificación deben presentarse con al menos 10 semanas de antelación a la reunión correspondiente del Comité Ejecutivo en la que se solicita el siguiente tramo de financiamiento para el PGEH y/o el PAK.

13. En el caso de Georgia, el PNUD es el principal organismo de ejecución de la etapa II del PGEH, y el PNUMA es el principal organismo de ejecución del PAK. Tras las conversaciones mantenidas entre los organismos de ejecución, el PNUD aceptó llevar a cabo la verificación combinada para Georgia, como figura en el cuadro anterior.

Recomendación de la Secretaría

14. La Secretaría recomienda la aprobación general de asistencia técnica para la preparación de los informes de verificación que se indican a continuación, con el nivel de financiamiento que figura en la sección A3 del cuadro 1, en el entendido de que los informes de verificación deben presentarse con al menos 10 semanas de antelación a la reunión correspondiente del Comité Ejecutivo en la que se soliciten los siguientes tramos de financiamiento para los PGEH o los PAK:

a) Consumo de HFC para la etapa I de los planes de aplicación de la Enmienda de Kigali relativa a los HFC (PAK) de El Salvador, Ghana y Uruguay;

b) Consumo de HCFC para la etapa II del plan de gestión para la eliminación de HCFC (PGEH) de Jamaica; y

c) Consumo de HFC y HCFC para la etapa I del PAK y la etapa II del PGEH de Costa Rica y Georgia.

A4: Preparación de un proyecto piloto destinado a mantener y/o mejorar la eficiencia energética de equipos y tecnologías sustitutivas en el contexto de la reducción de los HFC conforme a la decisión 91/65

15. El PNUD presentó diez solicitudes para la preparación de proyectos piloto destinados a mantener y/o mejorar la eficiencia energética de equipos y tecnologías sustitutivas en el contexto de la reducción de

[6] Se solicitó a la Secretaría que presentara, en la primera reunión de cada año, la lista de países con un consumo medio de HFC en servicio y mantenimiento, en los años de referencia, de 360 toneladas métricas (tm) o menos, que hubieran programado un tramo de sus PAK durante el año siguiente y que anteriormente no hubieran recibido financiamiento para realizar dichas verificaciones, y que incluyera también a aquellos países con un consumo medio de HFC en el sector de servicio y mantenimiento, en los años de referencia, superior a 360 tm que hubieran optado por recibir financiamiento como países de bajo consumo, de conformidad con la decisión 92/36 c).

[7] Se solicitó a la Secretaría que mantuviera el nivel de financiamiento recomendado para la verificación del consumo de HFC de los países con un consumo de hasta 360 tm en servicio y mantenimiento en los años de referencia en un nivel de hasta USD 30.000, o USD 45.000 cuando se combinara con la verificación del consumo de HCFC.

los HFC, en su calidad de organismo de ejecución designado, como se muestra en la sección A4 del cuadro 1. Las solicitudes se presentaron de conformidad con la decisión 91/65. La Secretaría examinó las propuestas de proyectos de acuerdo con los criterios establecidos en la decisión 91/65.

A4.1 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración industrial en Angola

Descripción del proyecto

16. El objetivo del proyecto preparatorio es elaborar una propuesta para un proyecto de demostración que implique la instalación y el funcionamiento de una cámara frigorífica que utilice un sistema en cascada de R-290/R-744 en una instalación de almacenamiento de alimentos seleccionada en Angola, en sustitución de un sistema existente basado en R-404A. Las actividades preparatorias incluirán un diagnóstico técnico y una evaluación de referencia, que comprenderán una auditoría de refrigerantes, análisis de datos energéticos, cálculos de la carga de refrigeración y evaluaciones del emplazamiento y de la seguridad para el sistema en cascada. El proyecto también llevará a cabo una evaluación técnica y económica que incluirá el diseño preliminar del sistema, la identificación de posibles proveedores y componentes, la estimación de costos y el análisis de los costos de operación previstos. Además, confirmará el cofinanciamiento por parte del beneficiario y apoyará la elaboración de una propuesta de proyecto completa.

Observaciones de la Secretaría

17. En cuanto a la replicabilidad, el PNUD afirmó que la tecnología en cascada de R-290/R-744 (propano/CO_2) seleccionada para las cámaras frigoríficas es replicable en sistemas centralizados de supermercados, ya que la misma arquitectura en cascada ya ha demostrado su eficacia para la refrigeración integrada a media y baja temperatura en tiendas minoristas de alimentos. Teniendo en cuenta el número total de 165.660 unidades (unidades centralizadas) en el país, se espera que la replicabilidad sea alta.

18. En respuesta a los planes de establecer un marco regulatorio para apoyar el despliegue, dado que las normas mínimas de eficiencia energética podrían no ser viables, el PNUD respondió que, con el apoyo de las actividades complementarias sobre eficiencia energética en virtud de la decisión 89/6, el proyecto propuesto potenciará las conversaciones con los organismos pertinentes de Angola para desarrollar una hoja de ruta normativa destinada a mejorar la eficiencia energética en las instalaciones de refrigeración, específicamente en las cámaras frigoríficas.

A4.2 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial en Barbados

Descripción del proyecto

19. El objetivo del proyecto preparatorio es elaborar una propuesta de proyecto para la demostración de tecnologías con alta eficiencia energética y de bajo PCA (R-290, R-717, R-744) en infraestructuras pesqueras, incluidos los mercados públicos de pescado y los puntos de desembarque. El proyecto también explorará la integración de sistemas de control digital para mejorar la gestión de la temperatura y optimizar el uso de energía, así como la integración de soluciones de energía renovable para equipos de alta demanda. Su objetivo es apoyar la transición hacia tecnologías de bajo PCA, al tiempo que se desarrolla un modelo escalable y replicable que pueda aplicarse a otros sectores, incluidos supermercados, hoteles e industrias de procesamiento de alimentos.

20. Las actividades preparatorias incluirán la selección de emplazamientos y planificación, investigación de antecedentes y evaluaciones sobre el terreno detalladas en las instalaciones candidatas para evaluar los equipos existentes, el uso de energía y las condiciones de seguridad. El proyecto también

revisará los marcos normativos pertinentes, realizará consultas con las partes interesadas, evaluará tecnologías de bajo PCA y opciones de energía renovable, y elaborará una propuesta de proyecto completa.

Observaciones de la Secretaría

21. La Secretaría solicitó información sobre la necesidad de un proyecto de preparación, señalando el tamaño de la aplicación que se prevé desplegar en la demostración y la disponibilidad de aplicaciones pequeñas y medianas ya disponibles en el mercado. El PNUD respondió que la resistencia de los proveedores de servicios es una barrera importante para la adopción de tecnologías de bajo PCA, ya que a menudo hacen hincapié en los riesgos percibidos y desalientan el cambio. Los problemas de fugas son más comunes en los sistemas de pequeña y mediana escala debido al envejecimiento de los equipos y a las malas prácticas de mantenimiento, a menudo reforzadas por los técnicos que se benefician al repetir las reparaciones. Para hacer frente a estos retos, se necesita un proyecto de preparación estructurado que permita mapear el sector, evaluar el estado de los equipos y las prácticas de mantenimiento, e involucrar a las partes interesadas, con el fin de generar confianza y apoyar la transición hacia tecnologías eficientes y sostenibles.

A4.3 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración en Belice

Descripción del proyecto

22. El objetivo del proyecto preparatorio es elaborar una propuesta de proyecto para demostrar la instalación y el funcionamiento de sistemas integrados de bombas de calor en determinadas instalaciones de procesamiento avícola de Belice. Este sector contribuye a la seguridad alimentaria, el empleo y la actividad económica, pero depende de sistemas de refrigeración y de agua caliente que consumen mucha energía, y que a menudo utilizan refrigerantes de alto PCA y carecen de datos exhaustivos sobre su uso actual. El proyecto preparatorio apoyará la transición hacia tecnologías integradas de bajo PCA para reducir las emisiones, mejorar la eficiencia energética y potenciar la competitividad, al tiempo que se establece un modelo replicable para los sistemas térmicos en todo el sector agroindustrial. El proyecto piloto previsto incluirá dos sistemas integrados de bombas de calor de tamaño medio capaces de proporcionar refrigeración y calefacción simultáneamente, utilizando diferentes tecnologías de bajo PCA (como R-290, R-717 o R-744). Estos sistemas sustituirán a los sistemas independientes de calefacción y refrigeración en instalaciones seleccionadas, demostrando su viabilidad técnica y económica para aplicaciones en procesos industriales. Se espera que los resultados contribuyan a la estrategia de Belice de armonizar los esfuerzos de reducción de los HFC con los objetivos de eficiencia energética.

23. Las actividades del proyecto de preparación incluyen una evaluación integral de las instalaciones de procesamiento avícola en Belice, que comprende el mapeo de los emplazamientos, la identificación de los refrigerantes utilizados y la evaluación de las necesidades de refrigeración y calefacción, junto con el consumo y los costos de energía. Se evaluarán las opciones tecnológicas adecuadas en función del rendimiento en las condiciones climáticas locales y los requisitos específicos del sector, se identificarán las instalaciones candidatas para la demostración y se desarrollarán diseños de ingeniería preliminares y estimaciones de costos para soluciones integradas de bombas de calor. Además, el proyecto examinará el potencial de cofinanciamiento, y preparará un plan de ejecución y una propuesta de proyecto.

Observaciones de la Secretaría

24. La Secretaría preguntó sobre la replicabilidad del proyecto y sobre la posibilidad de que otros sectores agroalimentarios industriales se beneficien de esta tecnología. El PNUD informó que el sector del procesamiento de carne de ave es una de las agroindustrias más importantes de Belice. En este contexto, una vez que la tecnología propuesta demuestre su eficiencia y rendimiento, se espera que sea replicada por un número significativo de empresas de todo el sector.

25. En Belice existen requisitos de normas de eficiencia energética mínima y de etiquetado energético para refrigeradores y equipos de aire acondicionado. Sin embargo, el equipo propuesto en el marco de este proyecto no entra dentro de las actuales normas de eficiencia energética mínima, y el PNUD confirmó que se elaborarán las directrices pertinentes para esta y otras tecnologías similares en el sector agroindustrial. En respuesta a la pregunta de la Secretaría sobre las opciones de políticas que podrían considerarse como resultado del proyecto, el PNUD confirmó que se elaborarán directrices para promover la adopción de esta y otras tecnologías similares.

A4.4 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial e industrial en Camboya

Descripción del proyecto

26. El objetivo del proyecto preparatorio para Camboya es elaborar una propuesta de proyecto para demostrar mejoras de la eficiencia energética en dos emplazamientos piloto dentro de los subsectores del almacenamiento en frío o los refrigeradores comerciales. El proyecto promoverá la adopción de tecnologías de bajo PCA, como los sistemas de CO_2 transcrítico o los sistemas en cascada de amoníaco-CO_2, para sustituir a los sistemas de refrigeración centralizados que actualmente utilizan refrigerantes HFC de alto PCA.

27. Las actividades preparatorias se centrarán en evaluaciones técnicas específicas, incluida la selección de instalaciones de refrigeración centralizada y refrigeradores comerciales que utilizan refrigerantes de alto PCA para identificar las instalaciones adecuadas. Los criterios de selección incluirán el uso de refrigerantes, la eficiencia energética, la antigüedad del sistema y la disposición a aportar cofinanciamiento. Luego se seleccionarán dos beneficiarios piloto para realizar evaluaciones detalladas de los emplazamientos con el fin de establecer datos de referencia y evaluar la viabilidad de los sistemas de CO_2 transcrítico o en cascada de amoníaco-CO_2, teniendo en cuenta factores técnicos, espaciales, de seguridad y de capacidad, y elaborar una propuesta de proyecto completa.

Observaciones de la Secretaría

28. La Secretaría solicitó aclaraciones sobre el sector destinatario del proyecto de preparación y pidió información adicional sobre los posibles sectores pertinentes. El PNUD indicó que la preparación del proyecto dará prioridad a los sistemas de refrigeradores comerciales de tamaño mediano a grande, en particular en industrias de procesamiento como el sector de la cadena de frío de alimentos, al tiempo que se tendrán en cuenta las instalaciones de almacenamiento en frío cuando proceda, dada su elevada carga de refrigerante y los riesgos de fuga; un proceso de selección estructurado identificará dos emplazamientos piloto, ya sean dos sistemas de refrigeradores comerciales o una combinación de un refrigerador comercial y una instalación de almacenamiento en frío, basándose en la viabilidad y el potencial de reducción de emisiones, centrándose en sistemas de CO_2 transcrítico y sistemas en cascada de amoníaco-CO_2.

29. En relación con los requisitos de replicabilidad y de capacidad, teniendo en cuenta el carácter avanzado y costoso de la tecnología en cascada de amoníaco-CO_2 propuesta, el PNUD señaló que, si bien la selección de la tecnología, que depende de numerosos parámetros, se decidirá durante la preparación del proyecto, dadas las ventajas de la tecnología propuesta y el crecimiento previsto en Camboya en el ámbito del almacenamiento en frío a gran escala, se espera que los sistemas en cascada de amoníaco-CO_2 se conviertan en una solución fiable y escalable adecuada para numerosos beneficiarios.

30. En relación con las políticas y normativas, el PNUD respondió que se espera que el proyecto propuesto genere importantes evidencias técnicas y de mercado que sirvan de base para futuras medidas de políticas y regulatorias destinadas a apoyar la transición hacia tecnologías de refrigeración de bajo PCA y alta eficiencia energética en los sectores comercial e industrial. Sobre la base de estos resultados, el Gobierno de Camboya, en futuras etapas del PAK, estudiará oportunidades para apoyar el desarrollo de

orientaciones o puntos de referencia indicativos para el consumo de energía y las emisiones en los sistemas de refrigeradores comerciales y almacenamiento en frío, así como consideraciones de eficiencia a nivel de sistema para los refrigeradores comerciales, el almacenamiento en frío y la refrigeración industrial, según proceda, y en consulta con las partes interesadas nacionales pertinentes.

A4.5 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial en Etiopía

Descripción del proyecto

31. El objetivo del proyecto preparatorio para Etiopía es elaborar una propuesta de proyecto para demostrar soluciones de almacenamiento en frío con alta eficiencia energética en el sector hortícola, centrándose en demostrar la viabilidad técnica y económica de las tecnologías de bajo PCA. Las actividades preparatorias incluirán el establecimiento de un nivel de referencia integral para el sector del almacenamiento en frío de Etiopía, que abarque las tecnologías existentes, el uso de refrigerantes, la eficiencia energética y las prácticas operativas. El proyecto también evaluará la viabilidad técnica, los requisitos de seguridad y el grado de preparación del mercado para alternativas de bajo PCA y alta eficiencia energética en las condiciones climáticas y operativas locales. Identificará a las partes interesadas clave, las carencias de capacidad y las condiciones propicias para la implementación, incluidas las necesidades de capacitación de técnicos, y apoyará la preparación de la propuesta de proyecto.

Observaciones de la Secretaría

32. En relación con el sector y la tecnología, el PNUD aclaró que el proyecto se centra en el sector hortícola, con especial atención al almacenamiento en frío de flores cortadas y hortalizas. Se prevé realizar una demostración de dos unidades móviles de almacenamiento en frío y dos instalaciones de tamaño medio para mostrar soluciones escalables. En la etapa preparatoria se realizará una evaluación técnica integral para identificar y seleccionar las opciones más adecuadas de refrigerantes de bajo PCA, tales como R-290, R-744 y R-717, basándose en su viabilidad técnica, consideraciones de seguridad, e idoneidad para las condiciones operativas y climáticas locales.

33. En relación con las políticas y las normas de eficiencia energética mínima, el PNUD afirmó que el proyecto generará datos y análisis para respaldar el desarrollo de políticas futuras, demostrando la viabilidad técnica y económica de soluciones de almacenamiento en frío de bajo PCA y alta eficiencia energética. Esta evidencia ayudará al gobierno a considerar opciones de políticas, tales como la integración de estas tecnologías en los planes de acción nacionales en materia de refrigeración, el establecimiento de normas de eficiencia energética mínima para la refrigeración comercial, la armonización de políticas nacionales como el PAK y las reglamentaciones energéticas, y el fortalecimiento de los marcos de creación de capacidad mediante la capacitación de técnicos, los requisitos de certificación y una mejor coordinación entre las instituciones pertinentes.

A4.6 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial en Guinea-Bissau

Descripción del proyecto

34. El objetivo del proyecto preparatorio es desarrollar una propuesta de proyecto para demostrar tecnologías con alta eficiencia energética y bajo PCA (sistemas de refrigeración con R-290 y R-744) en la cadena de frío médica de Guinea-Bissau. Las actividades preparatorias establecerán un nivel de referencia integral de la cadena de frío médica, incluidos los tipos de equipos, el uso de refrigerantes, la eficiencia energética y las prácticas de servicio técnico. Asimismo, evaluarán la viabilidad técnica, los requisitos de seguridad y el grado de preparación del mercado para tecnologías alternativas de bajo PCA y alta eficiencia energética en las condiciones climáticas y operativas locales. Además, el proyecto identificará a las partes

interesadas clave, las carencias de capacidad y las condiciones propicias para la implementación, incluidas las necesidades de capacitación de técnicos, y apoyará la preparación de la propuesta de proyecto completa.

Observaciones de la Secretaría

35. Con respecto al consumo de HFC, el parque de equipos y el potencial de crecimiento de este sector, el PNUD informó que la tecnología propuesta para la demostración de aplicaciones de almacenamiento en frío y refrigeración también presta servicios a los sectores de la agricultura, la pesca, la distribución de alimentos y los mercados locales, y que se prevé un aumento de la demanda. Sin una intervención temprana, este crecimiento podría dar lugar a un despliegue adicional de sistemas de refrigeración convencionales de alto PCA, en particular los que utilizan R-404A o mezclas similares.

36. Actualmente se está llevando a cabo el establecimiento de normas de eficiencia energética mínima en el país, como resultado del proyecto aprobado para actividades adicionales destinadas a mantener la eficiencia energética en el sector de servicio y mantenimiento de equipos de refrigeración, conforme a la decisión 89/6. Con respecto al uso de los resultados de este proyecto para elaborar políticas relacionadas con los refrigerantes de bajo PCA y la eficiencia energética para su aplicación en este sector, el PNUD confirmó que el Gobierno de Guinea-Bissau tiene la intención de utilizar los resultados de este proyecto como base para respaldar opciones de políticas que orienten la transición hacia sistemas de almacenamiento en frío con alta eficiencia energética y bajo PCA, y que la información y las pruebas generadas servirán directamente de base para la elaboración de su PAK.

A4.7 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial en la India

Descripción del proyecto

37. El objetivo del proyecto preparatorio para la India es elaborar tres proyectos destinados a demostrar tecnologías de refrigeración con alta eficiencia energética basadas en refrigerantes de bajo y ultrabajo PCA en aplicaciones de refrigeración comercial. El primer proyecto demostrará la aplicación de sistemas de refrigeración de CO_2 transcrítico y en cascada de CO_2 subcrítico y amoníaco de muy alta eficiencia para la refrigeración en cadenas de suministro de alimentos. El segundo proyecto se centrará en demostrar la integración del refrigerante HFO-1234ze y la mejora de la eficiencia energética en refrigeradores comerciales, y el tercer proyecto demostrará la transición al sistema R-744 en el segmento de las bombas de calor y la mejora de la eficiencia energética y el rendimiento de los sistemas.

38. Las actividades preparatorias incluyen recopilación de datos, análisis de los tipos de equipos que utilizan HFC y las modificaciones necesarias, incluyendo en qué sector o subsectores, consultas con las partes interesadas y expertos nacionales o internacionales, evaluaciones de resultados cuantificables, incluyendo la mejora de la eficiencia energética y la reducción de emisiones directas o indirectas de CO_2, así como el desarrollo del proyecto y consultas con ministerios, departamentos y partes interesadas relacionadas. El país cuenta con dos proyectos aprobados (de conformidad con la decisión 91/65); uno para mejorar la eficiencia energética de la fabricación, que se ejecutará en Rockwell Industries Limited, y otro para diseñar y desarrollar, a escala piloto, compresores rotativos de alta eficiencia energética junto con intercambiadores de calor de microcanales compatibles con la tecnología R-290 en Godrej & Boyce Mfg. Ltd. (Godrej)[8].

Observaciones de la Secretaría

39. Tras solicitarse información adicional, el PNUD indicó que los objetivos de los proyectos propuestos son instalar y poner en funcionamiento estos sistemas en los usuarios finales seleccionados para

[8] Decisiones 93/89 y 93/90.

evaluar las condiciones de la cadena de suministro, las capacidades del sector de la instalación y el costo de las tecnologías, con el fin de comprender el retorno de la inversión en eficiencia energética, que son aspectos fundamentales para apoyar la transformación del mercado. La experiencia práctica adquirida por el sector de servicio y mantenimiento a través de la instalación y el mantenimiento de estos sistemas alternativos les proporcionará los datos empíricos necesarios para elaborar y fiscalizar buenas prácticas de servicio y mantenimiento y normas de seguridad. Al subsanar la brecha de capacidades, estos proyectos actuarán como un catalizador fundamental para una transición más amplia del mercado hacia alternativas de bajo PCA durante la reducción de los HFC.

40. En relación con las normas de eficiencia energética mínima, el PNUD informó que la Oficina de Eficiencia Energética (BEE, por sus siglas en inglés) del Ministerio de Energía es el organismo central encargado de elaborar las normas de eficiencia energética mínima en el país. Actualmente, no existen normas de eficiencia energética mínima para el tipo de equipos de refrigeración que se propone poner a prueba en el proyecto, ya que estos se fabrican a medida según el tamaño de la instalación. No obstante, las conclusiones y los resultados del proyecto se compartirán con la Oficina de Eficiencia Energética para que esta pueda evaluar si es viable considerar la aplicación de normas de eficiencia energética mínima para el tipo de equipos incluidos en los tres proyectos. La Oficina de Eficiencia Energética forma parte del comité asesor que supervisa la preparación y la ejecución de estos tres proyectos.

A4.8 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial en Kenya

Descripción del proyecto

41. El objetivo del proyecto preparatorio para Kenya es desarrollar una propuesta de proyecto para demostrar sistemas de refrigeración con alta eficiencia energética y bajo PCA en la infraestructura de procesamiento y la cadena de frío del sector pesquero. Las actividades preparatorias incluirán un examen de las políticas pertinentes, el uso de energía y los sistemas de cadena de frío existentes para identificar las deficiencias en el rendimiento de la refrigeración, la eficiencia energética y la gestión operativa. Se llevarán a cabo evaluaciones sobre el terreno en centros pesqueros seleccionados para evaluar los equipos, la demanda de refrigeración y el consumo de energía. El proyecto también incluirá consultas con las partes interesadas y una evaluación de la viabilidad técnica de adoptar tecnologías de bajo PCA e integrar soluciones de energía renovable, así como la preparación de la propuesta.

Observaciones de la Secretaría

42. Tras la solicitud de información adicional sobre el tamaño del sector al que se dirigirá el proyecto, el PNUD informó que no se dispone de un inventario completo del parque de equipos y que este es uno de los objetivos principales del proyecto de preparación. En general, el sector pesquero de Kenya contribuye de manera significativa al consumo de HFC y presenta perspectivas de crecimiento, con un aumento previsto de la demanda de producción de hielo y almacenamiento en frío. El trabajo preparatorio estudiará opciones para demostrar soluciones que integren energías renovables y una gama de tamaños de aplicación pertinentes para el sector pesquero, y se espera que el proyecto que se desarrolle demuestre aplicaciones de distintas escalas pertinentes para el sector pesquero.

43. En relación con las políticas y la reglamentación, el PNUD informó que Kenya tiene previsto utilizar los resultados del proyecto para respaldar la formulación de políticas basadas en datos empíricos y alineadas con la Enmienda de Kigali y la estrategia de Economía Azul, lo que permitirá el desarrollo de un PAK específico para el sector pesquero. Las conclusiones orientarán la creación de reglamentaciones, normas e incentivos para promover tecnologías con alta eficiencia energética y de bajo PCA, al tiempo que se integra la refrigeración sostenible en las estrategias nacionales de seguridad alimentaria y resiliencia climática.

A4.9 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial en San Vicente y las Granadinas

Descripción del proyecto

44. El proyecto preparatorio para San Vicente y las Granadinas tiene como objetivo elaborar una propuesta para la demostración de sistemas de refrigeración con alta eficiencia energética y bajo PCA en las cámaras frigoríficas de los hoteles. Las actividades preparatorias incluyen la coordinación con las partes interesadas, la recopilación de datos y evaluaciones sobre el terreno para analizar el estado actual de las cámaras frigoríficas, el consumo energético, la seguridad y las necesidades operativas. Asimismo, se identificarán los retos y las carencias de capacidad, se evaluarán tecnologías alternativas adecuadas y opciones de energía renovable, y se utilizarán estos resultados para elaborar una propuesta de proyecto.

Observaciones de la Secretaría

45. En cuanto al tamaño y el tipo de cámaras frigoríficas a las que se dirigirá el proyecto, el PNUD respondió que el proyecto preparatorio llevaría a cabo una evaluación técnica detallada para determinar con precisión el tamaño, las condiciones de funcionamiento y la carga de refrigeración de las cámaras frigoríficas seleccionadas. Sobre la base de los resultados del proyecto, se podría considerar la adopción de la tecnología seleccionada, teniendo en cuenta su eficiencia y desempeño, en otras cámaras frigoríficas similares utilizadas en hospitales, hoteles y el sector comercial. El PNUD también abordó las preocupaciones de que la adopción de tecnologías disponibles comercialmente sin una labor preparatoria adecuada pudiera conllevar un alto riesgo de fracaso y limitar la replicabilidad. Las actividades preparatorias, que incluyen el establecimiento de un nivel de referencia técnico, la realización de un estudio de viabilidad y un análisis de seguridad, y la evaluación del potencial de replicación, permiten diseñar un proyecto de buena relación costo-beneficio, seguro, sostenible y que responda a las necesidades del país.

46. En el caso de San Vicente y las Granadinas, la Secretaría tomó nota de la decisión XXXVII/14 de la Reunión de las Partes sobre el incumplimiento del país para 2024 y de que el consumo de HFC, según los datos del artículo 7 para 2025 y el informe del programa país, se encuentra por debajo de los límites de control del Protocolo de Montreal. Por lo tanto, la recomendación sobre la solicitud de preparación para San Vicente y las Granadinas se formulará sin perjuicio del funcionamiento del mecanismo del Protocolo de Montreal para abordar el incumplimiento.

A4.10 Preparación de un proyecto para mejorar la eficiencia energética en el sector de la refrigeración comercial en Senegal

Descripción del proyecto

47. El objetivo del proyecto preparatorio para Senegal es desarrollar una propuesta para demostrar sistemas de refrigeración con alta eficiencia energética y bajo PCA en la infraestructura de procesamiento y la cadena de frío del sector pesquero. Las actividades del proyecto preparatorio evaluarán el nivel de referencia técnico, económico e institucional necesario para diseñar un proyecto piloto para una cadena de frío pesquera con alta eficiencia energética y bajo PCA. Esto incluye la evaluación de los sistemas existentes, incluidos los tipos de equipos, el uso de refrigerantes, la eficiencia energética y las prácticas de servicio y mantenimiento, así como la evaluación de la viabilidad, la seguridad y el grado de preparación del mercado para tecnologías alternativas de bajo PCA (incluidos los sistemas R-290, R-744 y R-717) en las condiciones locales. Además, el proyecto identificará a las partes interesadas clave, las carencias de capacidad y las condiciones propicias, incluidas las necesidades de capacitación y los marcos de supervisión para apoyar la implementación.

Observaciones de la Secretaría

48. La Secretaría destacó que la etapa I del PAK para Senegal incluía la demostración de unidades autónomas con R-290 para el sector pesquero y solicitó aclaraciones sobre la necesidad de un proyecto de demostración adicional. El PNUD aclaró que este proyecto se centra en un segmento diferente y más complejo de la cadena de frío en sistemas industriales de mediana a gran escala, como plantas de hielo en escamas o en bloques, túneles de congelación y cámaras frigoríficas de mayor tamaño. Estos sistemas requieren soluciones tecnológicas diferentes (como R-717 o R-744) y plantean retos distintos en términos de seguridad, capacidad técnica y costo. Las actividades del proyecto de preparación incluirán la elaboración de un inventario exhaustivo para determinar con precisión el número, la capacidad y el estado de los sistemas existentes, el establecimiento de un nivel básico de consumo energético mediante auditorías técnicas en emplazamientos seleccionados y la realización de un análisis detallado de viabilidad de tecnologías alternativas.

Recomendación de la Secretaría

49. La Secretaría recomienda la aprobación general de la preparación de proyectos para mejorar la eficiencia energética de las tecnologías y los equipos sustitutivos en el contexto de la reducción de los HFC (en virtud de la decisión 91/65) en Angola, Barbados, Belice, Camboya, Etiopía, Guinea-Bissau, India, Kenya, San Vicente y las Granadinas y Senegal, con los niveles de financiamiento que figuran en la sección A4 del cuadro 1, en el entendido de que la aprobación para San Vicente y las Granadinas no va en perjuicio de la aplicación del mecanismo del Protocolo de Montreal para abordar el incumplimiento.

A5: Preparación de un proyecto para mejorar la eficiencia energética en el contexto de la reducción de los HFC en el sector de la fabricación de equipos de refrigeración y aire acondicionado

50. El PNUD presentó una solicitud para la preparación de un proyecto destinado a mejorar la eficiencia energética en los sectores de la fabricación de equipos de refrigeración comercial ligera y de aire acondicionado de ambientes en Brasil. La solicitud se presentó de conformidad con la decisión 94/60.

Descripción del proyecto

51. El objetivo del proyecto preparatorio en Brasil es elaborar una propuesta de proyecto de eficiencia energética para 66 empresas de los sectores de la fabricación de equipos de refrigeración comercial ligera y de aire acondicionado de ambientes. La etapa preparatoria apoyará la elaboración de una propuesta de proyecto detallada alineada con el marco operativo, que incluirá evaluaciones de niveles básicos de referencia, la identificación de tecnologías con alta eficiencia energética y bajo PCA, análisis de costos y de costos incrementales, consultas con las partes interesadas y el diseño de un marco de ejecución, supervisión y verificación.

52. Las actividades preparatorias incluirán la organización de un taller nacional con las partes interesadas clave, una encuesta exhaustiva del sector de la refrigeración comercial para recopilar datos sobre las líneas de producción, la eficiencia energética, el uso de refrigerantes y el consumo de HFC, un taller técnico y la elaboración de la propuesta del proyecto.

Observaciones de la Secretaría

53. En respuesta a las consultas sobre el tipo de equipos de refrigeración comercial incluidos en el proyecto, el PNUD confirmó que se incluirían refrigeradores de botellas, congeladores de helados, vitrinas tipo góndola, vitrinas de varios niveles, vitrinas para helados y vitrinas de acceso frontal. La Secretaría

señala que 59 de las empresas incluidas en la parte del proyecto dedicada a la refrigeración comercial ligera son empresas que se convertirán al R-290 a través del PAK propuesto en la presente reunión.

54. En relación con las normas de eficiencia energética mínima para el sector de la refrigeración comercial, el PNUD informó que el proceso de establecimiento de normas de eficiencia energética mínima para la refrigeración comercial está incluido en la agenda regulatoria del país. Se prevé que este proceso concluya a principios de 2027, tras lo cual las normas entrarán en vigor el 1 de enero de 2028.

55. La Secretaría señaló que el PNUD había solicitado USD 165.000 para este proyecto de preparación. Sin embargo, tras mantener conversaciones con la Secretaría y de conformidad con la decisión 94/60 (y el párrafo 73 del documento UNEP/OzL.Pro/ExCom/95/87), el PNUD modificó la solicitud a USD 81.000 para la preparación correspondiente de 66 empresas.

Recomendación de la Secretaría

56. La Secretaría recomienda la aprobación general de la preparación de un proyecto para mejorar la eficiencia energética en el contexto de la reducción de los HFC en el sector de la fabricación de equipos de refrigeración y aire acondicionado en Brasil, con los niveles de financiamiento que figuran en la sección A5 del cuadro 1.

Annex I

INSTITUTIONAL STRENGTHENING PROJECT PROPOSALS[9]

Chile: Renewal of institutional strengthening

Summary of the project and country profile		
Implementing agency:		UNDP
Amounts previously approved for institutional strengthening (US $):		
	Phase I: Jun-92	210,907
	Phase II: Oct-96	128,255
	Phase III: Jul-98	162,155
	Phase IV: Dec-00	162,155
	Phase V: Nov-02	233,350
	Phase VI: Apr-05 and Nov-05	200,542
	Phase VII: Mar-07	200,141
	Phase VIII: Apr-09	200,523
	Phase IX: Apr-11	200,486
	Phase X: Apr-13	199,608
	Phase XI: May-15	193,125
	Phase XII: Jul-17	255,499
	Phase XIII: May19	255,318
	Phase XIV: Jul-21	254,885
	Phase XV: Jun-23	528,883
	Total:	3,385,832
Amount requested for renewal (phase XVI) (US $):		494,283
Amount recommended for approval for phase XVI (US $):		494,283
Agency support costs (US $):		34,600
Total cost of institutional strengthening phase XVI to the Multilateral Fund (US $):		528,883
Date of approval of country programme:		1992
Date of approval of HCFC phase-out management plan:		2011
Date of approval of Kigali HFC implementation plan:		2023
Baseline consumption of controlled substances (ODP tonnes/CO_2-eq tonnes):		
(a) Annex B, Group III (methyl chloroform) (average 1998-2000)		6.4
(b) Annex C, Group I (HCFCs) (average 2009-2010)		87.5
(c) Annex E, (methyl bromide) (average 1995-1998)		212.5
(d) Annex F (HFCs) (average 2020-2022 plus 65% of HCFC baseline)		6,698,107
Latest reported ODS consumption (2024) (ODP tonnes) as per Article 7:		
(a) Annex B, Group III (methyl chloroform)		0.00
(b) Annex C, Group I (HCFCs)		16.23
(c) Annex E, (methyl bromide)		0.00
	Total:	16.23
(d) Annex F (HFCs) (CO_2-eq tonnes) as per Article 7		3,581,813
Year of reported country programme implementation data:		2025
Amount approved for projects (as at December 2025) (US $):		23,619,499
Amount disbursed (as at December 2024) (US $):		20,680,387
ODS to be phased out (as at December 2025) (ODP tonnes):		1,508.4
ODS phased out (as at December 2024) (ODP tonnes):		1,073.2

57. Summary of activities and funds approved by the Executive Committee:

Summary of activities	**Funds approved (US $)**
a) Investment projects:	13,252,200

[9] Data as at December 2024 are based on document UNEP/OzL.Pro/ExCom/97/13.

Summary of activities	Funds approved (US $)
b) Institutional strengthening:	3,385,832
c) Project preparation, technical assistance, training and other non-investment projects:	6,981,467
Total:	23,619,499
d) HFC activities funded from additional voluntary contributions	150,000

Progress report

58. During phase XV, the national ozone unit (NOU) of Chile implemented the institutional strengthening (IS) project, achieving all seven objectives based on the performance indicators reported. The Government of Chile successfully integrated the NOU into the Ministry of the Environment's climate governance structure, strengthening coordination between Montreal Protocol activities and the national climate agenda. The technical team remained unchanged, helping to preserve institutional knowledge and continuity. The adoption and entry into force of Decree No. 7/2024 established control measures for HCFC and HFC consumption and enabled the implementation of HFC import quotas. The NOU supported the effective operation of the HCFC and HFC licensing system and worked closely with the Customs Service to strengthen monitoring, control and enforcement. Customs detected illegal imports of HCFC-141b formulated polyols, which were reported to the Public Prosecutor's Office. Chile submitted Article 7 and country programme data. The project supported capacity-building for refrigeration and air-conditioning (RAC) technicians and customs officers, strengthened RAC certification, and promoted increased participation of women in the RAC sector. The NOU supported the implementation of stage III of the HCFC phase-out management plan (HPMP), stage I of the Kigali HFC implementation plan (KIP), and advanced key actions under the Kigali Amendment, including HFC inventories, regulatory development and energy-efficiency initiatives. The Government of Chile further strengthened coordination with national institutions, industry associations and training institutions, and continued its active participation in regional and international Montreal Protocol meetings.

Plan of action

59. During phase XVI, the NOU will continue awareness-raising, information dissemination and coordination with relevant national institutions and stakeholders. The project will support the implementation of Decree No. 7/2024, including the operationalization of the HFC quota system, and will strengthen licensing, monitoring, enforcement and the prevention of illegal trade. Collaboration with the Customs Service will continue, including training activities and capacity-building. The project will support the continued implementation of stage III of the HPMP and stage I of the KIP. Capacity-building will continue for technicians, and other stakeholders, with a focus on increasing women's participation and certification in the RAC sector. The project will also explore, with certification centres, options to monitor the professional development and career progression of certified women in the RAC sector. The NOU will continue to collect, validate and report ODS and HFC consumption data to the Ozone and Fund Secretariats, and strengthen monitoring and evaluation of project implementation. The NOU will apply standardized procedures to improve the efficiency of approvals, procurement, recruitment and reporting.

Sustainability and risk assessment

60. The sustainability of Chile's IS project is supported by the integration of the NOU within the organizational structure of the Ministry of the Environment and by its coordination with other State institutions. The work of the NOU is monitored by the Head of the Department of Climate Mitigation and Transparency within the Climate Change Division, the monitoring and control mechanisms of the Ministry of the Environment, and the implementing agencies, helping to ensure the sustainability of its actions and results over time. Chile's stable economy and institutional framework minimize institutional risks for project implementation. The project also benefits from strong technical expertise, which minimizes risks associated with the introduction of new technologies.

Lebanon: Renewal of institutional strengthening

Summary of the project and country profile			
Implementing agency:			UNDP
Amounts previously approved for institutional strengthening (US $):			
	Phase I:	May-96	179,000
	Phase II:	Jul-00	119,300
	Phase III:	Jul-02	155,090
	Phase IV:	Dec-04	155,090
	Phase V:	Nov-06	155,090
	Phase VI:	Nov-08	155,090
	Phase VII:	Dec-10	155,090
	Phase VIII:	Dec-12	155,090
	Phase IX:	Nov-14	155,090
	Phase X:	Dec-16	198,515
	Phase XI:	Dec-18	198,515
	Phase XII:	Dec-20	198,515
	Phase XIII:	Jun-23	439,691
		Total:	2,583,409
Amount requested for renewal (phase XIV) (US $):			410,926
Amount recommended for approval for phase XIV (US $):			410,926
Agency support costs (US $):			28,765
Total cost of institutional strengthening phase XIV to the Multilateral Fund (US $):			439,691
Date of approval of country programme:			1996
Date of approval of HCFC phase-out management plan:			2011
Date of approval of Kigali HFC implementation plan:			2025
Baseline consumption of controlled substances (ODP tonnes/CO_2-eq tonnes):			
(a) Annex B, Group III (methyl chloroform) (average 1998-2000)			0.0
(b) Annex C, Group I (HCFCs) (average 2009-2010)			73.5
(c) Annex E (methyl bromide) (average 1995-1998)			236.4
(d) Annex F (HFCs) (average 2020-2022 plus 65% of HCFC baseline)			2,556,533
Latest reported ODS consumption (2024) (ODP tonnes) as per Article 7:			
(a) Annex B, Group III (methyl chloroform)			0.00
(b) Annex C, Group I (HCFCs)			18.32
(c) Annex E (methyl bromide)			0.00
		Total:	18.32
(d) Annex F (HFCs) (CO_2-eq tonnes) as per Article 7			1,573,653
Year of reported country programme implementation data:			2025
Amount approved for projects (as at December 2025) (US $):			27,913,766
Amount disbursed (as at December 2024) (US $):			24,573,251
ODS to be phased out (as at December 2024) (ODP tonnes):			2,013.0
ODS phased out (as at December 2021) (ODP tonnes):			1,861.7

61. Summary of activities and funds approved by the Executive Committee:

Summary of activities	**Funds approved (US $)**
a) Investment projects:	21,819,243
b) Institutional strengthening:	2,583,409
c) Project preparation, technical assistance, training and other non-investment projects:	3,511,114
Total:	27,913,766
d) HFC activities funded from additional voluntary contributions	1,233,858

Progress report

62. During phase XIII, from August 2023 to March 2026, the NOU of Lebanon implemented the institutional strengthening (IS) project, achieving all seven objectives based on the performance indicators reported. Lebanon maintained compliance with its Montreal Protocol obligations through continued regulatory and enforcement measures, including the HCFC-22 ban in the industrial and manufacturing sector and the issuance of HCFC and HFC import quotas for 2024 and 2025. The IS project was instrumental in strengthening national capacity, enhancing inter-agency coordination and supporting enforcement of control measures, including improved customs capacity to identify illegal shipments. The NOU also advanced the development of minimum energy performance standards (MEPS) and labelling regulations, maintained Article 7 and country programme data reporting, updated customs and ODS/HFC user data, supported operational RAC training centres and the certification of technicians, and oversaw activities, including those under stages II and III of the HPMP and stage I of the KIP, as well as the approval of digital monitoring and ODS banks preparatory projects. Lebanon remained active in regional and international Montreal Protocol processes, while gender mainstreaming progressed through gender-disaggregated reporting and at least 15 per cent female participation in RAC technician training.

Plan of action

63. Phase XIV will support Lebanon's efforts to meet its obligations under the Montreal Protocol and the Kigali Amendment, including the complete phase-out of HCFCs by 2030 and a 10 per cent reduction in HFC consumption by 2029. The project will strengthen the management of controlled substances through measures such as the planned ban on HFC-134a-based domestic refrigerators and R-410A-based residential air conditioners by 31 December 2027, while supporting the implementation of stage III of the HPMP servicing activities and stage I of the KIP industrial conversions. The project will continue to strengthen the NOU's operational capacity, including support for the HFC licensing and quota system, data collection and coordination with customs and relevant stakeholders. It will also enhance institutional capacity by formalizing coordination with the Ministry of Energy and Water, Civil Defence and other partners to align sustainable cooling, climate and safety priorities. In addition, the NOU will support digital monitoring and ODS banks initiatives, update data collection for HFC blends and equipment, and sustain awareness-raising and capacity-building activities focused on energy-efficient, low-GWP technologies, safe handling of alternatives and women's participation in the refrigeration sector. Gender-related activities will focus on strengthening enabling conditions for women's participation in the RAC sector.

Sustainability and risk assessment

64. Phase XIV will be implemented under UNDP's National Implementation Modality, ensuring strong national ownership by the Government of Lebanon, with the Ministry of Environment serving as the implementing partner and co-chair of the Project Board. UNDP will provide implementation support, including financial, procurement and operational oversight, in accordance with its rules and procedures. Project risks will be identified, managed and monitored through UNDP's Enterprise Risk Management framework, including the Harmonized Approach to Cash Transfers, the Social and Environmental Screening Procedure, procurement due diligence mechanisms and the project risk log, under Project Board oversight. The UNDP project risk register identifies risks related to safety and security, enforcement, data reliability and regulatory consistency. These risks will be addressed through continuous monitoring, adaptive implementation modalities, strengthened inter-agency coordination, capacity-building and the prioritization of essential compliance-related activities. The three-year implementation period provides flexibility to support the continuity of core compliance functions, including the licensing and quota system and coordination with customs and importers. Where needed, implementation modalities will be adjusted, including through remote operations, virtual engagement and activity sequencing based on risk and priority.

Anexo II

CONSIDERACIONES PRELIMINARES DEL COMITÉ EJECUTIVO EN CUANTO A LA RENOVACIÓN DE LOS PROYECTOS DE FORTALECIMIENTO INSTITUCIONAL PRESENTADOS ANTE LA 98ª REUNIÓN

Chile

1. El Comité Ejecutivo examinó el informe presentado junto con la solicitud de renovación del proyecto de fortalecimiento institucional para Chile (fase XVI) y tomó nota con satisfacción de que Chile continuaba cumpliendo sus obligaciones en virtud del Protocolo de Montreal, incluida la presentación de los datos del artículo 7 y del programa nacional, así como la aplicación de controles a la importación de HCFC y HFC a través del sistema de licencias. El Comité tomó nota además del fortalecimiento del marco regulatorio nacional, las medidas adoptadas para aplicar el sistema de cupos de HFC y la integración de la ONO en la estructura de gobernanza climática del Ministerio del Medio Ambiente. El Comité reconoció los esfuerzos del Gobierno de Chile por reforzar los controles aduaneros, incluidas las medidas contra el comercio ilegal, y por impulsar las actividades en el marco de la Enmienda de Kigali. Por lo tanto, el Comité confía en que, durante los próximos tres años, Chile continuará aplicando la etapa III del plan de gestión para la eliminación de los HCFC y la etapa I del plan de aplicación de la Enmienda de Kigali relativa a los HFC, y fortalecerá aún más el sistema de cupos de HFC, con el fin de mantener el cumplimiento del Protocolo de Montreal y alcanzar sus objetivos de reducción.

Líbano

2. El Comité Ejecutivo examinó el informe presentado junto con la solicitud de renovación del proyecto de fortalecimiento institucional para el Líbano (fase XIV) y tomó nota con satisfacción de los continuos esfuerzos del país por mantener el cumplimiento de sus obligaciones en virtud del Protocolo de Montreal, incluida la fiscalización de los sistemas de licencias y cupos para controlar el consumo de HCFC, de conformidad con su Acuerdo con el Comité Ejecutivo. El Comité reconoció además el compromiso del Líbano de mantener los avances en la eliminación de SAO a pesar de los importantes retos nacionales, incluidas las limitaciones económicas y las perturbaciones relacionadas con la seguridad, al tiempo que garantiza la continuidad de actividades clave como la fiscalización de políticas, la creación de capacidades y la participación de las partes interesadas. El Comité también tomó nota de las medidas adoptadas para avanzar en la aplicación de la Enmienda de Kigali, incluidas las actividades preparatorias y los mecanismos de coordinación destinados a apoyar la ejecución del plan de aplicación de la Enmienda de Kigali relativa a los HFC. El Comité elogió al Líbano por el fortalecimiento de la coordinación institucional y las iniciativas de sensibilización y, por lo tanto, confía en que, durante los próximos tres años, el Líbano continuará avanzando en la reducción de los HFC, promoviendo la eficiencia energética en el sector de la refrigeración y manteniendo el cumplimiento del Protocolo de Montreal.

98th Meeting of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol

(22-26 June 2026)

UNDP
2026 WORK PROGRAMME

I. EXECUTIVE SUMMARY

This document constitutes UNDP's 2026 Work Programme (WP) and is being submitted for consideration by the Executive Committee (ExCom) at its 98th Meeting.

Consistent with UNDP's Business Plan for 2026–2028, this document includes only non-investment and proposals submissions, detailed in section II:

- Submission of Institutional Strengthening Extensions
- Preparation of Stage I Kigali Implementation Plans (KIP).
- Preparation funding requests for Energy Efficiency Project Preparation under decisions 91/65 and 94/60
- Other requests for non-investment projects including HCFC and HFC Verification Reports

Project documentation such as tranche requests under multi-year agreements (MYA), investment and demonstration project proposals and other individual proposals are not included in this document and are submitted separately as per normal practice.

Annex I includes Preparation funding requests.

II. SUMMARY OF FUNDING REQUESTS (WORK PROGRAMME)

The tables below summarize the funding requests for non-investment activities and proposals submitted to the 98th ExCom Meeting as part of UNDP's Work Programme for 2026:

Institutional Strengthening Extensions

UNDP is submitting the requests for funding the extension of institutional strengthening projects to the 98h ExCom Meeting as tabulated below. Relevant terminal reports and requests for extension of funding are being submitted separately.

Country	Type	Title	Duration (months)	Amount	Agency Fee	Total
Chile	INS	Several Ozone unit support	36	494,283	34,600	528,883
Lebanon	INS	Several Ozone unit support	36	410,926	28,765	439,691
Total (2 requests)				**905,209**	**63,365**	**968,574**

Preparation funding requests for Stage I Kigali Implementation Plans (KIP).

UNDP is submitting the following funding requests for the preparation of the Stage I KIP to the 98h ExCom meeting.

Country	Type	Title	Duration (months)	Amount	Agency Fee	Total
Haiti	PRP	HFC Phase-down Plan preparation	24	130,000	9,100	139,100
India	PRP	HFC Phase-down Plan preparation	24	450,000	31,500	481,500
India	PRP	Preparation funding requests for HFC phase down Investment Projects	24	60,000	4,200	64,200
Total (3 requests)				**640,000**	**44,800**	**684,800s**

Project preparation (PRP) requests for pilot projects to maintain and/or enhance energy efficiency of replacement technologies and equipment in the context of HFC phase-down

Pursuant to the ExCom decisions 91/65, UNDP is submitting the following requests for the preparation of pilot projects to maintain and/or enhance energy efficiency of replacement technologies and equipment in the context of HFC phase-down. Annex I contains the PRP Request submissions.

Country	Type	Title	Duration (months)	Amount	Agency Fee	Total
Angola	PRP	Pilot Project for EE (91/65) - Preparation	12	30,000	2,100	32,100
Barbados	PRP	Pilot Project for EE (91/65) - Preparation	12	30,000	2,100	32,100
Belize	PRP	Pilot Project for EE (91/65) - Preparation	12	30,000	2,100	32,100
Cambodia	PRP	Pilot Project for EE (91/65) - Preparation	12	30,000	2,100	32,100
Ethiopia	PRP	Pilot Project for EE (91/65) - Preparation	12	30,000	2,100	32,100
Guinea-Bissau	PRP	Pilot Project for EE (91/65) - Preparation	12	30,000	2,100	32,100
India	PRP	Pilot Project for EE (91/65) - Three pilot projects	12	50,000	3,500	53,500

Kenya	PRP	Pilot Project for EE (91/65) - Preparation	12	30,000	2,100	32,100
Saint Vincent and the Grenadines	PRP	Pilot Project for EE (91/65) - Preparation	12	30,000	2,100	32,100
Senegal	PRP	Pilot Project for EE (91/65) - Preparation	12	30,000	2,100	32,100
Total (10 requests)				**320,000**	**22,400**	**342,400**

Project preparation (PRP) requests for pilot projects to maintain and/or enhance energy efficiency in the RAC manufacturing sectors in the context of HFC phase-down

Pursuant to the ExCom decisions 94/60, UNDP is submitting the following requests for the preparation of pilot projects to maintain and/or enhance energy efficiency in the RAC manufacturing sectors in the context of HFC phase-down. Annex I contains the PRP Request submissions.

Country	Type	Title	Duration (months)	Amount	Agency Fee	Total
Brazil	PRP	Preparatory Assistance for an Energy Efficiency Project in the Refrigeration and Air Conditioning Sector (94/60)	12	81,000	5,670	86,670
Total (1 request)				**81,000**	**5,670**	**86,670**

Other requests for non-investment projects

UNDP is requesting the ExCom to approve the funding for the verification of HCFC and HFC consumption[1] at its 98th meeting.

Country	Type	Title	Duration (months)	Amount	Agency Fee	Total
Costa Rica	VER	HCFC & HFC Verification	12	45,000	4,050	49,050
El Salvador	VER	HFC Verification	12	30,000	2,700	32,700
Georgia	VER	HCFC & HFC Verification	12	45,000	4,050	49,050
Ghana	VER	HFC Verification	12	30,000	2,700	32,700
Jamaica	VER	HCFC Verification	12	30,000	2,700	32,700
Uruguay	VER	HFC Verification	12	30,000	2,700	32,700
Total (6 requests)				**210,000**	**18,900**	**228,900**

[1] As per decision 96/22

III. SUMMARY OF FUNDING REQUESTS (WORK PROGRAMME)

The table below summarizes the funding requests for non-investment activities and proposals submitted to the 98th ExCom Meeting as part of UNDP's Work Programme for 2026:

No.	Country	Type	Description	Funding Request to the 96th ExCom (US$)		
				Amount	Agency Fee	Total
1	Chile	INS	Several Ozone unit support	494,283	34,600	528,883
2	Lebanon	INS	Several Ozone unit support	410,926	28,765	439,691
3	Angola	PRP	Pilot Project for EE (91/65) - Preparation	30,000	2,100	32,100
4	Barbados	PRP	Pilot Project for EE (91/65) - Preparation	30,000	2,100	32,100
5	Belize	PRP	Pilot Project for EE (91/65) - Preparation	30,000	2,100	32,100
6	Cambodia	PRP	Pilot Project for EE (91/65) - Preparation	30,000	2,100	32,100
7	Ethiopia	PRP	Pilot Project for EE (91/65) - Preparation	30,000	2,100	32,100
8	Guinea-Bissau	PRP	Pilot Project for EE (91/65) - Preparation	30,000	2,100	32,100
9	India	PRP	Pilot Project for EE (91/65) - Three pilot projects	50,000	3,500	53,500
10	Kenya	PRP	Pilot Project for EE (91/65) - Preparation	30,000	2,100	32,100
11	Saint Vincent and the Grenadines	PRP	Pilot Project for EE (91/65) - Preparation	30,000	2,100	32,100
12	Senegal	PRP	Pilot Project for EE (91/65) - Preparation	30,000	2,100	32,100
13	Brazil	PRP	Preparatory Assistance for an Energy Efficiency Project in the Refrigeration and Air Conditioning Sector (94/60)	81,000	5,670	86,670
14	Haiti	PRP	HFC Phase-down Plan preparation	130,000	9,100	139,100
15	India	PRP	HFC Phase-down Plan preparation	450,000	31,500	481,500
16	India	PRP	Preparation funding requests for HFC phase down Investment Projects	60,000	4,200	64,200
17	Costa Rica	VER	HCFC & HFC Verification	45,000	4,050	49,050
18	El Salvador	VER	HFC Verification	30,000	2,700	32,700
19	Georgia	VER	HCFC & HFC Verification	45,000	4,050	49,050

20	Ghana	VER	HFC Verification	30,000	2,700	32,700
21	Jamaica	VER	HCFC Verification	30,000	2,700	32,700
22	Uruguay	VER	HFC Verification	30,000	2,700	32,700
Total (22requests)				**2,156,209**	**155,135**	**2,311,344**

Notes:

a. All amounts in are in US dollars.

b. Special reports due (delays, balances, status reports, etc.) as well as other projects not part of the WPA will be submitted separately.

ANNEX I

Preparation funding requests

HFC Phase-down Plan preparation

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL
KIGALI-HFC IMPLEMENTATION PLAN (KIP) PROJECT PREPARATION (PRP)
KIGALI HFC PHASE DOWN PLAN (OVERARCHING STRATEGY)

PLEASE ADJUST THE TEXT IN THE ANNEX IN LINE WITH THE TEXT IN THE GUIDE

Part I: Project information

Project title:	HFC Phase-Down Plan Preparation	
Country:	Haiti	
Lead implementing agency:	UNDP	
Cooperating agency (1):	(select)	Click or tap here to enter text.
Cooperating agency (2):	(select)	Click or tap here to enter text.
Cooperating agency (3):	(select)	Click or tap here to enter text.
Implementation period for stage I of the KIP:	July 2026-July 2028	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the KIP (please specify):		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Overarching	130,000
(select)	(select)	Click or tap here to enter text.
(select)	(select)	Click or tap here to enter text.
(select)	(select)	Click or tap here to enter text.

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

A. Information required for PRP funding request for the overarching strategy of the KIP

1. Montreal Protocol compliance target to be met in ☐ stage I of the KIP			
Phase-out commitment (%)	**10%**	**Year of commitment**	**2030**
☒ Servicing only		**☐ Manufacturing only**	**☐ Servicing and manufacturing**

2. Brief background/description/information on approved relevant projects and multi-year agreements as follows:

- The current progress in implementation of any funded HFC-related project (enabling activities or stand-alone HFC investment projects)
- The current progress in ongoing HCFC phase-out management plan (HPMPs)
- Consideration of integrating HFC phase-down activities with HPMP activities taking into account previously approved HFC-related projects, if this information is available.

1. Current progress in implementation of any funded HFC-related project (enabling activities or stand-alone HFC investment projects)

Following the outcomes of the 84th Meeting of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol and subsequently Decision 84/55, funding was approved for Haiti for Enabling Activities to prepare for the HFC phase-down and to assure the early ratification of the Kigali Amendment (KA) which happened on April 08, 2026. Taking into consideration that the Kigali Amendment to the Montreal Protocol came into force on the 1st of January 2019, and that Haiti has updated its reporting mechanism to include HFCs, the country will be able to follow up on the standard reporting obligation under the Kigali Amendment. Haiti has already created an enabling environment for the phasedown of HFCs. Likewise, under the aforementioned project, it should be noted that information was obtained on the consumption and use of HFCs and their substitutes for the period 2020-2025. In addition, the economic evaluation of the implications that the implementation of the Kigali amendment would generate in the country was estimated.

In the project "Enabling Activities for the Kigali Amendment", activities were carried out, including the following:

- Assessment and analysis of the national legislative process for the ratification of the Kigali Amendment.
- Analysis of legislation and policies for the Implementation of the Kigali Amendment.
- Assessment of the national legislative process for the ratification of the Kigali Amendment.
- Assessment of the licensing and quota systems for ODS to determine measures to extend control over HFCs.
- Analysis of the consumption and use of HFCs and their alternatives in the refrigeration and air conditioning sectors.
- Raising awareness of the ratification and implementation process for the Kigali Amendment

2. The current progress in ongoing HCFC phase-out management plan (HPMPs)

Despite of the social and political challenges in the country, Haiti has been in compliance with the Montreal Protocol control targets
Stage I of the HPMP for Haiti was originally approved at the 68th meeting to phase out 1,26 ODP tons of HCFCs used int he refrigeration and air-conditioning (RAC) servicing sector to meet the 35% reduction from the baseline by 2020. A project completion report was submitted in January 2024.
As per the HPMP II, the project was approved at 96th meeting and it is moving forward on the implementation with national inventory of training institutions and refrigeration technicians, training workshops for customs officers on the detection of controlled substances.
Overall, it is expected that the country will phase-out HCFCs by 2030. To ensure sustainable phase-out, the country is focusing on strengthening the HCFC import licensing and quota system, the capacities of RAC technicians to work with non-ODS and low-GWP substances, and the promotion of new energy-efficient technologies.

3. Consideration of integrating HFC phase-down activities with HPMP activities taking into account previously approved HFC-related projects, if this information is available.

There are no HFC-related investment projects that have been approved to date.

3. Overview of current HFC consumption in metric tonnes by substance (last three years)

Substance/blend	Sector	2023	2024	2025
HFC-134a	RAC servicing	8.31	4.24	14.16
R-404A	RAC servicing	10.34	7.44	8.09
R-407A	RAC servicing	0.68	0.22	0.908
R-410A	RAC servicing	14.26	9.87	17.74
HFC-32	RAC servicing			0.59
TOTAL	**(select)**	**33.59**	**21.77**	**41.488**

4. Based on the consumption data given above, please provide a description of the sector/sub-sector that use HFCs in the country, including a short analysis and explanation of the consumption trends (i.e., increasing or decreasing)

The main sectors where currently the different refrigerants are used is shown in the following table:

Refrigerants used in Haiti in average 2020- 2025

Subsector						
	R-410A	**HFC-134a**	**R-404A**	**R-407A**	**HFC-32**	**Total**
Domestic refrigeration	-	10.57	-	-	-	10.57
Commercial self-contained refrigeration	-	1.32	-	-	-	1.32
Transport refrigerated	-	-	1.69	-	-	1.69
Residential AC	10.78	-	-	0.17	0.59	11.54
Commercial AC	-	-	-	0.39	-	0.39
Commercial installations	-	-	6.77	-	-	6.77
MAC	-	2.45		-	-	2.45
Total use	**10.78**	**14.34**	**8.47**	**0.56**	**0.59**	**34.74**

Sectors such as residential AC, domestic refrigeration and commercial installations are still one of the largest consumers. Residential air conditioning is expected to continue growing exponentially due to the replacement of HCFC-based ACs into HFC based, and both domestic refrigeration and commercial installations are also expected to grow if no other alternative is introduced soon.

Also, after the economic recession during the COVID-19 Pandemic, it is expected an economic recovery that will increase the AC and refrigeration markets increasing consequently the use of HFCs is the cheapest and available technology by the time being. With the
Kigali Amendment implementation, it is expected to curve that possible increase and start the reduction in the consumption of HFCs.

The sectoral consumption calculations developed under the implementation of the Kigali EA have shown the distribution of HFC consumption among the following sectors during the last two years:

Sector	2024	2025	Total
MAC			
HFC-134a	0.72	2.42	3.14
Commercial AC			
R-407A	0.15	0.64	0.79
Residential AC			
R-410A	9.87	17.74	27.61
R-407A	0.07	0.27	0.34
HFC-32	-	0.59	
Commercial self-contained refrigeration			
HFC-134a	0.39	1.30	1.69
Domestic Refrigeration			
HFC-134a	3.13	10.44	13.56
Commercial installations			
R-404A	5.95	6.47	12.42
Transport refrigerated			
R-404A	1.49	1.62	3.11
Total (MT)	**21.77**	**41.49**	**31.12**

The table above sheds some light on the main sectors that the phasedown plan should focus on, namely residential AC, domestic, and commercial refrigeration. However, additional information about the alternatives and strategies for the technologies to be introduced should be provided.

Finally, the MAC sector in Haiti, played an important role during CFC phase-out but there have been no activities in this sector in the past 10 years as HCFCs are not used in MAC. It will be important to better understand the dynamics of this sector as it is key in the country.

5. Description of information that needs to be gathered during project preparation. Explain how this data will be gathered

Information needed	Description	Agency
Data on HFC consumption in manufacturing/servicing sector	Data will be obtained through questionnaires, site visits, interviews with relevant stakeholders	UNDP
HFC sectoral consumption information	Data will be obtained through questionnaires, site visits, interviews with relevant stakeholders	UNDP
Analysis of types of equipmentt using HFCs	Data will be obtained through questionnaires, site visits, interviews with relevant stakeholders	UNDP

New information on ODS regulations	Data will be obtained through questionnaires, site visits, interviews with relevant stakeholders	UNDP
6. Activities to be undertaken for project preparation and funding (decision 87/xx(b))		
Activity	**Indicative funding (US $)**	**Agency**
Gathering detailed information on the consumption of HFCs and their substitutes across sectors pending analysis: foam production, solvents, aerosols, firefighting. Data will be collected through structured interviews and surveys.	25,000	UNDP
Development of an economic evaluation of the transition from HFCs to environmentally friendly substitutes in controlled sectors, assessing feasibility and cost implications	15,000	UNDP
Assessment of current country conditions in sectors already surveyed, updating records of HFC consumption and the introduction of alternatives, including newly developed blends.	25,000	UNDP
Assessment of training and certification needs at the country level in the use of flammable refrigerants, development of a training plan and organization of workshops with the main stakeholders and training institutions	30,000	UNDP
Preparation of the national strategy for the gradual reduction of HFCs, which includes the evaluation and identification and prioritization of sectors. This must include the analysis of emission reductions, according to the potential of GWP	30,000	UNDP
Dissemination and awareness-raising actions for the actors involved, in order to present the results obtained on the	5,000	UNDP

consumption of HFCs and raise awareness for their reduction.		
TOTAL	**130,000**	

7. How will activities related to preparing the KIP be linked to the current stages of the HPMP being implemented in the country? (OPTIONAL)

The second tranche of HPMP II for Haiti is being submitted for the 100th meeting of the ExCom and HCFCs will be phased out (100 %) by 2030. The activities in stage II HPMP focus on the sustainable phase-out in the use of HCFCs and, to the extent possible, promote the safe use of low GWP alternatives. The stage II HPMP for Haiti is being implemented by the Ministry of Environment.

It is expected that there will be synergies among the HPMP and the HFC phase-down, particularly taking into account that the HPMP II focuses in the certification of technicians and training in good refrigeration practices in the use of flammable refrigerants. Nevertheless, these programs should be expanded to other refrigerants, including the recovery of HFC pure and blends.

It is important to highlight that the phase-out of HCFCs can be achieved by applying currently available non-flammable and nontoxic technologies, primarily through the use of HFCs. In contrast, the phase-down of HFCs presents a far more complex challenge, as it inevitably requires the large-scale introduction of refrigerants that are flammable and/or toxic.

Ensuring the safe handling of these substances by all technicians nationwide represents a task of a significantly greater magnitude than previously encountered. This effort must encompass not only comprehensive training programs for technicians, but also the development, updating and enforcement of standards, safety guidelines and regulatory frameworks to guarantee the safe management of refrigerants.

In that sense, UNDP identifies the main synergy as stemming from the coordination of all activities under a single government entity: the Ministry of Environment (National Ozone Unit), for both, HCFC phase-out and HFC phase-down.

The current funding requested has been prepared in line with the established HFC funding guidelines. However, both, the Government of Haiti and UNDP emphasize that additional resources will be required to fully implement the preparatory work necessary to carry out the tasks outlined in this document.

8. How will the Multilateral Fund gender policy be considered during project preparation?

Dring the preparation of the KIP, gender consideration will be mainstreamed in line with the Multilateral Fund's Gender Policy. Disaggregated data on gender participation in trainings, workshops and stakeholder consultations will be collected and analysed to ensure equal opportunities for women and men. Special attention will be given to capturing the role of women in the refrigeration and air-conditioning servicing sector, as well as in decision-making and policy-related functions. Where possible, targeted outreach will be conducted to encourage women's participation in capacity-building activities and consultations. The analysis of this data will inform the design of training programs, awareness campaigns and policy recommendations, with the aim of promoting gender balance and ensuring that women and men can equally benefit from, and contribute to, the implementation of the Kigali Amendment in Haiti.

B. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

1. Agency:	(select)
2. Sector:	(select)
3. HFC consumption in item #2 reported under country programme data?	☐ **Yes**, please specify reported amount and year: _____ ☐ **No**
4. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter _____ ☐ **No**
5. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No**
6. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	

7. Information on sector consumption (specify previous year HFC consumption)

Substance	**Consumption (metric tonnes)**
(select)	
(select)	
(select)	

8. Information on enterprise(s) for which funding is being sought

Enterprise	**Year established**	**HFC consumption (metric tonnes) (last three years)**			**HFC phase-out to be achieved (metric tonnes and CO_2-eq. tonnes)**
		2019	**2020**	**2021**	

9. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (US $)	Bilateral/implementing agency
Click or tap here to enter text.		
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Click or tap here to enter text.		
Click or tap here to enter text.		
TOTAL		

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL
HFC PHASE-DOWN PROJECT PREPARATION REQUEST FORM
HFC PHASE-DOWN MANAGEMENT PLAN (OVERARCHING STRATEGY)
HFC PHASE-DOWN SECTOR PLANS (REFRIGERATION AND AC)

Part I: Project Information

Project title:	Stage-I of the Kigali Amendment's HFCs Phase-down Management Plan Preparation (PRP KIP-I) and associated Sector Plans for Refrigeration and AC	
Country:	India	
Lead implementing agency:	UNDP	
Cooperating agency (ies):	To be decided during the preparation of KIP Stage-I	
Preparation period:	July 2026 – July 2028 (24 months)	
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Overarching	230,000
UNDP	INV - REF	110,000*
UNDP	INV - AC	110,000*

*Decision 87/50 (f)(v) limits the maximum funding provided for the preparation of the investment component to India at USD 400,000
At the 93rd ExCOM, four (4) standalone HFCs preparation projects were approved at USD 120,000
At the 98th ExCOM, additional two (2) standalone HFCs preparation projects are being requested at USD 60,000

Part II: Prerequisites for submission

Item	**Yes**	**No**
1. Official endorsement letter from Government specifying roles of respective agencies (where more than one IA is involved)	☒	☐
2. Country has ratified the Kigali Amendment?	☒	☐

C. Information required to support PRP funding (Overarching strategy)

9. Montreal Protocol compliance target to the HFCs Phase-down; to be determined

Phase-out commitment (%)	**TBD**	**Year of commitment**	**TBD**
☐ Servicing only		☐ Manufacturing only	X Servicing and manufacturing

10. Brief background

The current progress in implementation of any funded HFC-related project (enabling activities or stand-alone HFC investment projects)
The current progress in ongoing HCFC phase-out management plan (HPMPs)
Consideration of integrating HFC phase-down activities with HPMP activities taking into account previously approved HFC-related projects, if this information is available.

India ratified the Kigali Amendment to the Montreal Protocol on 27 September 2021. The Kigali Amendment came into force for India on 26 December 2021. As per the provisions of

the Montreal Protocol, licensing system has been put in place before 26 March 2022. Data reporting on HFCs and blends containing HFCs is being done starting the year 2021

Regarding HCFC phase out, India has met the 2013, 2015, 2020 and 2025 compliance targets as per the accelerated phase out schedule of the Montreal Protocol through implementation of HPMP Stage-1, HPMP Stage-2 and HPMP Stage-3, as well as through the policy and regulatory framework put in place for HCFC phase out. India also complied with the provisions of agreement with the ExCom both HPMPs The Stage-3 of the HPMP approved in the 91st meeting of the ExCom of the MLF is under implementation, under which 2025 compliance targets for HCFCs have been achieved. Also, phase out of HCFCs in new manufacturing has been achieved as on 1.1.2025 Activities in the servicing sector will continue till 2030.

For advancing the Kigali Amendment implementation, two (2) standalone HFC phase-down (investment) projects had been approved under ExCOM Decision 87/50 – one in commercial refrigeration sector and second in commercial Airconditioning – for which project completion reports are under finalisation. In addition, one (1) project titled "Design and development of a pilot scale energy efficient rotary compressor along with microchannel heat exchanger compatible to R-290 technology at Godrej & Boyce Mfg. Co. Ltd., for use in manufacturing of room air-conditioners" has been implemented under ExCOM Decision 91/65, for which project completion report is under finalisation.

11. Current progress in implementation of Enabling Activities for HFC phase-down

The enabling activities project (EA Project) for India under the Kigali Amendment was approved at the 80th Meeting of the Executive Committee (ExCom) of the Multilateral Fund. The EA project was designed to support India in meeting its initial obligations under the Kigali Amendment. These typically include:

a) Initial National HFC inventory and baseline assessment
b) Assessment of policy, legal, and institutional frameworks.
c) Stakeholder consultations with industry and line ministries.
d) Awareness-raising and capacity-building on HFC phase-down obligations.
e) Planning for the development of a national strategy**.**

The Enabling Activity project has been completed. The country has ratified the Kigali Amendment on 27 September 2021 and has functioning HFC licensing system. The licensing system was thoroughly assessed during the implementation of the Enabling Activity, and it was concluded that it captures well the imports and exports of HFCs in the country.

Finally, there has been a strong public awareness campaign around the Kigali Amendment and several activities for awareness-raising among different governmental and non-governmental stakeholders have been carried out in the country.

4. Overview of estimated use of ODS alternatives as per EA Results up to 2021, and prior to Country Programme reporting started:

The **Kigali Enabling Activities (EA)** for India confirmed that **HFC consumption is highly concentrated in a small number of rapidly growing cooling-related sectors**, with clear implications indicating need for further in-depth assessments under KIP Stage I preparation process.

The EA indicated that **room air-conditioning manufacturing and servicing represent the largest share of HFC consumption in India**, driven by: rapid urbanization; rising household incomes; and stronger domestic manufacturing capacity. High-GWP HFC blends (notably **HFC-410A) followed by HFC-32 were dominant in this segment.**

The EA found **substantial HFC use in commercial refrigeration**, including supermarkets and cold chains and food processing and retail, consumption is more fragmented than in RAC, with **mixed slow uptake of low-GWP alternatives** starting in parts of the sector. Growth is strongly linked to **cold-chain expansion**, logistics modernization, and food security investments.

The EA highlighted the **importance of the HFC servicing sector**, which cuts across RAC, commercial refrigeration, and transport refrigeration due to rising demand for virgin HFCs due to servicing needs, limited recovery, reclamation, and reuse infrastructure ; and training needs for technicians handling low-GWP alternatives

The EA confirmed that **foams, aerosol (inc. MDIs) and fire-fighting applications account for a relatively small share of national HFC consumption** in India.

(b) Overview of current HFC consumption in metric tonnes by substance, as per surveyed Country Programme Report

Substance	Year	Year	Year	Year
Given the large quantity of HFCs consumed by India, data on HFCs for the years 2022, 2023 and 2024 is enclosed at **Annexure – I** ** Data for 2025 is under compilation				
TOTAL				

5. Based on the estimated use/consumption data given above, please provide a description of the sector/sub-sector that use HFCs in the country, including a short analysis and explanation of the consumption trends (i.e., increasing or decreasing)

The sectoral analysis indicates that HFC consumption is predominantly driven by the refrigeration and air-conditioning manufacturing and servicing sectors**,** which account for the use of a wide range of gases including HFC-32, HFC-134a, HFC-125, and blends such as R-404A, R-407C, R-410A, and others. In addition to these core sectors, foam manufacturing also represents a significant area of application, utilizing gases like HFC-245fa, HFC-152a, and HFC-365MFC/227EA blends. The pharmaceutical sector has a specialized but important role, particularly through the use of HFC-134a and HFC-227ea in metered dose inhalers (MDIs).

Other niche applications include aerosols, solvents, firefighting, glass blowing, and chillers, along with emerging uses in research and development for new refrigerant blends such as R-454B**.** Overall, the data highlights that while cooling-related sectors dominate HFC usage, a diverse range of industrial and specialized applications contribute to the overall sectoral distribution.

HFC consumption shows a clear and accelerating upward trend over the period 2022–2024, increasing from 43,688 MT in 2022 to 48,772 MT in 2023 and further to 60,281 MT in 2024**,** reflecting an overall rise of about 38%**.** The growth is particularly sharp in 2024. The consumption pattern remains highly concentrated, with HFC-32, HFC-134a, HFC-125, and R-410A accounting for the bulk of usage. Among these, HFC-32 exhibits the most significant increase**,** while HFC-125 shows a notable surge in 2024**,** and HFC-134a remains consistently high across all years. Blended refrigerants and newer HFC variants show gradual but comparatively lower contributions. Overall, the data indicates a steady expansion in both the volume and composition of HFC consumption during the period under review.

Once the KIP-I preparation activities start in India, all concerning phase-down strategy aspects would be considered during development of overarching strategy for Stage-I of the KIP

6. Assessment of commonly used alternatives to HFCs available in the local market

The most commonly used alternatives to HFCs available in the local market are listed in the table below:

Application	Baseline Refrigerant	Alternative Refrigerant
MAC	R-134a	n/a
Domestic Refrigerators	R-134a	R-600a
Commercial Refrigerators	R-134a, R-404a, R507	R-134a, R-290
Condensing Units	R-134a, R-404A	HFCs/HFOs blends, R-290
Process Chillers	R-134a, R-410A	HFCs/HFOs blends, HFOs
Room ACs	R-410A	R-32, R-290 (minor extent)

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Light Commercial ACs	R-410A	R-32
Other Commercial ACs	R-410A, R407C	R-32
Chillers	R-134a, R-410A, R407C	HFOs
MDIs	R-134a, R-227ea	n/a
Fire-fighting	R-227ea	n/a
Solvents and Sterilant	Several	n/a
PU Foam	HFC-365mfc, HFC-245fa	HCs, HFOs, H2O, Methyl Formate, Methylal

Today, most of the ODS alternatives are HFCs, and they are used mainly in the different RAC sectors. However, HCFCs are gradually being phased-out, and the demand for HFCs is expected to increase in the short term to satisfy the expected growth in the country due to the work that has been done in the context of the HPMP activities. Blends of HFCs, and to a minor extent, HFOs, are also used in servicing sector.

7. Description of information that needs to be gathered and updated.

Information needed	Description	Agency
Updated data on HFC consumption in manufacturing/servicing during the baseline formation years	Conducting interviews, organizing workshops and stakeholders' consultations for the integration of national regulations and procedures for KA implementation and consolidation of technical capacities in the institutions involved in HFC control until 2026.	UNDP
Updated sectoral consumption information	Assessment of country level needs for trainings and certification in use of flammable refrigerants, developing training plan and organizing workshops with main stakeholders and training institutions; including assessments of the needs for enhancing training programs on recovery, recycling and destruction	UNDP
Analysis of types of equipment using HFCs (Manufactured locally and imported)	Update current market profile and trends of use of HFCs-based equipment and Data collection by sector/sub-sector/	UNDP
New information on ODS regulations	Further review current regulatory framework and carry on a holistic assessment on their effectiveness to better identify potential remaining barriers to be removed.	UNDP
Others, specify.	Carry on proper consultations with stakeholders, validate results of the surveys and the PRP process, draft the updated over-arching strategy and the cooling servicing sector plan, endorse strategies with stakeholders, obtain approvals from institutions responsible for the MP framework in country, translate documents, submit document to ExCom.	UNDP

8. Project preparation funding

Activity	Indicative funding (US $)	Agency

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Update HCFCs downstream data.	45,00	UNDP
Assess country level needs	25,000	UNDP
Collect by sector/sub-sector	125,000	UNDP
Carry on Gender Assessment and Stakeholders Engagement Plans and Asses Implementation Risks/Partner Capacities for future implementation	10,000	UNDP
Carry on Stakeholders Meetings (including missions)	25,000	UNDP
TOTAL	**230,000 ……**	

9. How will activities related to implementation of the stage III of the HPMP implementation be considered during project preparation for the HFC phase-down management plan?

The HPMP-III for India is delivering activities focused on the sustainable phase-out in the use of HCFCs.

Also, differently from Group 1 countries, the overlapping period between the HPMP and KIP-I will be reduced to roughly 2 years of implementation (2028-2030), and the HFCs phase-down is a much more complex task as it requires inevitably the full-scale introduction of flammable and/or toxic refrigerants.

The Ozone Cell of the MoEF&CC considers coordinating with all stakeholders including line ministries/departments and agencies for the activities for the HFC phase down and sound implementation framework will be developed, as done during implementation of HPMPs

10. How will the Multilateral Fund gender policy be considered during project preparation?

During the project preparation, gender considerations and actions on gender mainstreaming will be assessed and a proper Gender Management Plan is to be included in the Over-arching strategy: The following actions are expected to be carried in the preparation phase:

a) To collect data to produce gender-disaggregated indicators
b) Look into introduction of gender considerations when designing components and activities o (presentation of sex-disaggregated data and visuals of women and men where applicable);

c) To establish a baseline of women technicians in R&AC sector and compare it with the number of women involved in NOU R&AC activities.
d) To incorporate gender aspects in the recruitment of staff for the PRP (emphasizing that female candidates are welcome and encouraged to apply)
e) Assurance that consultants and project personnel have the required gender competence to reflect on progress and challenges related to gender.
f) Draft a Gender Management Plan to be supported as part of the over-arching strategy

D. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

10. Agency:	UNDP
11. Sector:	Refrigeration
12. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and 2024. ☐ **No**
13. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☒ **Yes**, please provide support letter ☐ **No**
14. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☒ **Yes** ☐ **No**
15. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	The HPMP of India reached our 250+ HCFC consuming companies assisting them to convert to HCFC-free technologies (particularly HFC-32 and HC-290 in AC-R sectors). Yet, it is estimated that 200+ companies not assisted under HPMP still use high GWP HFCs impacting the consumption profile of India with a relevant manufacturing sector demand. Hence, the development of an AC-R Sector Plan will be critical to support HFCs phase-down reduction strategy of India.

16. Information on sector consumption (specify previous year HFC consumption)

Substance	**Consumption (metric tonnes)**
India has submitted the Country Programme consumption reports to the ExCOM for years 2021, 2022, 2023 and 2024 providing top-down consumption breakdown per manufacturing and servicing sector. However, detailed updated bottom-up sub-sector and application analysis of HFCs use/demand are expected to be fully developed during the preparation of the KIP I.	

17. Information on enterprise(s) for which funding is being sought

Enterprise	**Year established**	**HFC consumption (metric tonnes) (last three years)**			**HFC phase-out to be achieved (metric tonnes and CO_2-eq. tonnes)**
		2019	**2020**	**2021**	

The information will be collected as part of the questionnaire to be developed for data collection and included in the project proposal for each enterprise.

18. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (US $)	Bilateral/implementing agency
Data collection at companies' level for HFC conversion (including travel costs and third-party verification)	130,000	UNDP
Consultation with stakeholders including national and international experts time and travel costs	Covered by Over-arching PRP	UNDP
Project design and consolidation with draft proposals, consolidate inputs from stakeholders, finalisation of the project proposal, translation and support during project review process with MLF.	70,000	UNDP
Consultation with nodal line ministries/departments, related stakeholders and finalisation of the project proposal	Covered by Over-arching PRP	UNDP
Independent Peer Review	20,000	UNDP
TOTAL	**220,000**	

Annexure – I

HFC 2022 Data

HFCs		Production	Import	Export	Consumption
HFC-32	Mt	9590.20	8994.68	2391.383	16193.497
	mt CO_2-eq	6473385	6071409	1614183.525	10930610.48
HFC-125	Mt	8754.751	122.26	4874.95	4002.061
	mt CO_2-eq	30641628.5	427910	17062325	14007213.5
HFC-134a	Mt	14727.82	9125.191	6112.542	17740.469
	mt CO_2-eq	21060782.6	13049023.13	8740935.06	25368870.67
HFC-152a	Mt		2940.478	4.970	2935.508
	mt CO_2-eq		364619.272	616.28	364002.992
HFC-227ea	Mt		263.973	0.415	263.558
	mt CO_2-eq		849993.06	1336.3	848656.76
HFC-236fa	Mt		72.584	0.155	72.429
	mt CO_2-eq		712049.04	1520.55	710528.49
HFC-245fa	Mt		1064.839	0	1064.839
	mt CO_2-eq		1096784.17	0	1096784.17
HFC-365MFC	Mt		38.4	0	38.4
	mt CO_2-eq		30489.6	0	30489.6
HFC-43-10mee	Mt		0.6	0	0.6
	mt CO_2-eq		984		984
HFC-23	Mt		0	0	0
	mt CO_2-eq		0	0	0
R-404A	Mt		1265.6	227.334	1038.266
	mt CO_2-eq		4963683.2	891603.948	4072079.252
R-407C	Mt		718.92	274.371	812.049**
	mt CO_2-eq		1275364.08	486734.154	1440574.926
R-407F	Mt		1.452		1.452
	mt CO_2-eq		2649.9		2649.9
R-410A	Mt		3887.67	4627.717	3814.326**
	mt CO_2-eq		8117454.96	9662673.096	7964312.688
R-426A	Mt		20	0	20
	mt CO_2-eq		30160		30160
R-438A	Mt		200	0	200
	mt CO_2-eq		452800		452800
R-467A	Mt		0	37.800	0
	mt CO_2-eq			51370.2	
R-454B	Mt		0.176	0	0.176
	mt CO_2-eq		81.84	0	81.84
R-454C	Mt		0.073	0	0.073
	mt CO_2-eq		10.585	0	10.585
R-455A	Mt		0.8	0	0.8
	mt CO_2-eq		116	0	116
R-513A	Mt		0.684	0	0.684

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HFCs		Production	Import	Export	Consumption
	mt CO_2-eq		430.236	0	430.236
HFC-365mfc/HFC-227ea	Mt		115.2	0	115.2
	mt CO_2-eq		132480	0	132480

**As per Article-7 and Country Programme Progress Report, no need to report the production of mixtures/blends. However, the consumption is calculated considering R-407C production= 367.5 MT and R-410A production= 4554.373 during the year 2022.

HFC 2023 Data

HFC		Production (MT)	Export (MT)	Import (MT)	Consumption (MT)
HFC-32	MT	11459.11	2856.496	8844.9	17447.514
	mt CO2-eq	7734899.25	1928134.8	5970307.5	11777071.95
HFC-41	MT	0	0	0.000025	0.000025
	mt CO2-eq	0	0	0.0023	0.0023
HFC-125	MT	10282.102	7126.832	373.975	3529.245
	mt CO2-eq	35987357	24943912	1308912.5	12352357.5
HFC-134a	MT	13476.12	5367.726	7701.665	15810.059
	mt CO2-eq	19270851.6	7675848.18	11013380.95	22608384.37
HFC-227ea	MT	0	5.07	308.626	303.556
	mt CO2-eq	0	16325.4	993775.72	977450.32
HFC-152a	MT	0	0	4502.914	4502.914
	mt CO2-eq	0	0	558361.336	558361.336
HFC-245fa	MT	0	0	1772.705	1772.705
	mt CO2-eq	0	0	1825886.15	1825886.15
HFC-236fa	MT	0	0.52	84.908	84.388
	mt CO2-eq	0	5101.2	832947.48	827846.28
HFC-365MFC	MT	0	0	19.8	19.8
	mt CO2-eq	0	0	15721.2	15721.2
HFC-43-10mee	MT	0	0	0.9	0.9
	mt CO2-eq	0	0	1476	1476
R-404A	MT		239.016	1294.8	1055.784
	mt CO2-eq		937420.752	5078205.6	4140784.848
R-407C	MT		492.533	538.776	598.943
	mt CO2-eq		858977.552	939625.344	1044556.592
R-410A	MT		5922.993	3492.061	2971.608
	mt CO2-eq		12367209.38	7291423.368	6204717.504
R-426A	MT		0	40	40
	mt CO2-eq		0	60320	60320

R-438A	**MT**		0	260	260
	mt CO2-eq		0	588640	588640
R-448A	**MT**		0	5.896	5.896
	mt CO2-eq		0	8171.856	8171.856
R-449A	**MT**		0	0.999	0.999
	mt CO2-eq		0	1394.604	1394.604
R-454B	**MT**		0	0.521	0.521
	mt CO2-eq		0	242.265	242.265
R-454C	**MT**		0	0.184	0.184
	mt CO2-eq		0	26.68	26.68
R-508B	**MT**		0	1.278	1.278
	mt CO2-eq		0	8700.624	8700.624
R-513A	**MT**		0	1.368	1.368
	mt CO2-eq		0	860.472	860.472
HFC-365mfc/HFC-227ea* (87%/13%)	**MT**		0	364.8	364.8
	mt CO2-eq		0	419520	419520

***As per Article-7, no need to report the production of mixtures/blends. However, the consumption is calculated considering R-407C production= 552.70 MT and R-410A production= 5402.540 during the year 2023.**

HFC 2024 Data

HFC		Production (MT)	Export (MT)	Import (MT)	Consumption (MT)
HFC-23	MT	0	0	18	18
	mt CO2-eq	0	0	266400	266400
HFC-32	MT	23583.22	4841.093	4678.462	23420.589
	mt CO2-eq	15918673.5	3267737.775	3157961.85	15808897.58
HFC-125	MT	9177.708	2943.3	2006.231	8240.639
	mt CO2-eq	32121978	10301550	7021808.5	28842236.5
HFC-134a	MT	13739.15	4301.421	5901.916	15339.645
	mt CO2-eq	19646984.5	6151032.03	8439739.88	21935692.35
HFC-227ea	MT	0	3.083	266.983	263.9
	mt CO2-eq	0	9927.26	859685.26	849758
HFC-152a	MT	0	0	5186.489	5186.489
	mt CO2-eq	0	0	643124.636	643124.636
HFC-245fa	MT	0	0	349.5	349.5
	mt CO2-eq	0	0	359985	359985
HFC-236fa	MT	0	1.27	101.48	100.21
	mt CO2-eq	0	12458.7	995518.8	983060.1
HFC-43-10mee	MT	0	0	3.948	3.948
	mt CO2-eq	0	0	6474.72	6474.72
R-404A	MT		348.793	2596.906	2248.113
	mt CO2-eq		1367966.146	10185065.33	8817099.186

The Multilateral Fund Secretariat

R-407C	**MT**		384.448	82.56	505.852
	mt CO2-eq		670477.312	143984.64	882205.888
R-410A	**MT**		6959.709	1089.02	4291.109
	mt CO2-eq		14531872.39	2273873.76	8959835.592
R-438A	**MT**		0	120	279.7
	mt CO2-eq		0	271680	633240.8
R-449A	**MT**		0	7.042	7.042
	mt CO2-eq		0	9830.632	9830.632
R-449C	**MT**		0	1.298	1.298
	mt CO2-eq		0	1622.5	1622.5
R-454B	**MT**		0	8.596	8.596
	mt CO2-eq		0	3997.14	3997.14
R-507A	**MT**		0	14.49	14.49
	mt CO2-eq		0	57742.65	57742.65
R-508B	**MT**		0	0.84	0.84
	mt CO2-eq		0	5718.72	5718.72
R-513A	**MT**		0	0.938	0.938
	mt CO2-eq		0	590.002	590.002
HFC-365mfc/HFC-227ea	**MT**		38.4	0	0
	mt CO2-eq		44160	0	0

***As per Article-7 and Country Programme Progress Report, no need to report the production of mixtures/blends. However, the consumption is calculated considering R-407C production= 807.740 MT, R-410A production= 10161.798 and R-438A production=159.70 MT during the year 2024.**

Pilot Project for EE (91/65) – Preparation

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Preparation for a pilot project to maintain and/or improve the energy efficiency of replacement technologies and equipment in the context of HFC phase-down: demonstration project for the use of low-GWP refrigerant in the industrial refrigeration sector	
Country:	Angola	
Lead implementing agency:	UNDP	
Implementation period for the energy efficiency project:	36 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Servicing	30,000 USD

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

E. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

19. Agency:	UNDP
20. Sector:	Refrigeration
21. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2025 ☐ **No**
22. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter ☐ **No** ☒ **N/A**
23. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once	☒ **Yes** ☐ **No** ☐ **N/A**

approved, will be deducted from the country's starting point, once established?	
24. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	The project will directly contribute to Angola's strategy to integrate HFC phase-down with national energy efficiency objectives.

25. Project Description

Background and Rationale

1. Angola is experiencing rapid growth in its refrigeration and air-conditioning (RAC) sector, driven by population growth, urban expansion, post-pandemic economic recovery, and increasing demand for thermal comfort, food preservation, and cold-chain services for domestic consumption and export. The expansion of residential and commercial buildings, refrigerated transport, and industrial cold-chain applications has accelerated the uptake of HFC-based technologies following the phase-out of CFCs and HCFCs. The sectoral survey conducted during preparation of Stage I of Angola's Kigali Implementation Plan (KIP) indicates that, while a large share of HFC consumption is concentrated in domestic and commercial air-conditioning and mobile air-conditioning, centralized refrigeration and large-capacity systems used in commercial and industrial applications represent a strategically important and emissions-intensive segment of the market.
2. Angola's HFC consumption has increased sharply in recent years, reflecting both the rapid expansion of the equipment stock and high servicing demand. Average HFC consumption over the 2020–2022 baseline period was dominated by HFC-134a, R-404A, and R-410A. HFC-134a accounted for approximately 581 metric tonnes (around 38 per cent of total HFC mass), largely associated with domestic refrigeration and mobile air-conditioning. R-404A represented about 385 metric tonnes (25 per cent of total mass) but contributed a disproportionately high share of CO_2-equivalent emissions due to its very high GWP, particularly in fixed commercial and centralized refrigeration systems. R-410A consumption reached approximately 271 metric tonnes (18 per cent of total mass), primarily in residential and commercial air-conditioning. The Angola HFC baseline was estimated at approximately 3.9 million tonnes of CO_2-equivalent, underscoring the climate significance of high-charge and centralized refrigeration applications.
3. Cold storage and industrial refrigeration systems in Angola operate under hot tropical conditions, with high ambient temperatures that increase cooling loads, compression ratios, and electricity consumption. Large centralized systems serving food processing, mining, oil, and logistics facilities typically operate continuously and have long equipment lifetimes. As in many developing RAC markets, the majority of refrigerant consumption occurs during servicing, reflecting leakage from extensive piping networks, ageing equipment, and variable servicing practices. The KIP highlights ongoing challenges related to refrigerant recovery and reuse, limited availability of lower-GWP alternatives, and continued reliance on high-GWP refrigerants such as R-404A in commercial and industrial refrigeration. This creates a risk of long-term lock-in of HFC-based technologies at a time when Angola must progressively reduce HFC consumption in line with its Kigali Amendment commitments, which Angola ratified in 2020. [UNDP_97thE..._I_Request | Word]
4. Despite the global maturity of many low-GWP technologies, their adoption in Angola remains very limited. The KIP notes that low-GWP alternatives are not yet widely available or cost-effective in the local market, and that local contractors and service technicians have limited experience with advanced refrigeration technologies. Potential investors and equipment owners therefore lack confidence in the absence of local performance data under Angolan operating conditions. Demonstrating low-GWP refrigeration in Angola's commercial and industrial

sectors at this stage would help close a critical technical, capacity, and market confidence gap, supporting compliance with Kigali obligations while addressing the country's growing demand for reliable and energy-efficient refrigeration and air conditioning applications.

Status of implementation of energy efficiency-related activities funded by the Multilateral Fund

5. Angola ratified the Kigali Amendment on 16 November 2020. It has a functional licensing system since ratification and developed an HFC import quota system in 2025. The KIP (stage I, first tranche) was approved at the 97th ExCom in 2025.
6. As part of the Kigali Amendment implementation strategy, Angola will mobilize all sectors of its economy, with a special focus on refrigeration and air conditioning (RAC) industries, alongside public engagement and awareness. The overarching objective is to facilitate the transition to low-GWP technologies in a manner that is coordinated, sustainable, and socially responsible. Priority will be given to the adoption of alternatives to HFCs that are characterized by low or zero global warming potential and reduced energy consumption, thereby enhancing both environmental and economic resilience
7. Under Stage I of the Kigali HFC Implementation Plan (KIP), Angola's approved activities focus primarily on establishing the enabling framework for HFC phase-down, including strengthening the legal and licensing system, improving HFC data collection, enhancing customs and enforcement capacity, and upgrading servicing-sector practices. Stage I also supports the gradual introduction of lower-GWP alternatives in selected equipment categories through training and awareness-raising. However, the scope of Stage I does not extend to centralized refrigeration rack systems or large-capacity cold storage and chiller installations, which typically operate with high refrigerant charges of R-404A, R-507A, or HFC-134a. These systems involve significantly larger refrigerant inventories, more complex architectures, and much higher long-term emission and energy implications, and therefore require a distinct technical assessment and demonstration pathway.
8. The Executive Committee has already approved a set of foundational measures for Angola under Stage I of the KIP, aimed at ensuring effective implementation of the Kigali Amendment. These measures emphasize institutional strengthening, licensing and quota systems for HFC imports, improvements in servicing practices, technician training, and enhanced monitoring and reporting. The approved programme addresses the broad RAC servicing sector and establishes the regulatory and capacity backbone needed to control future HFC growth, but it does not include site-specific demonstrations of alternative technologies for large, high-charge refrigeration applications.
9. In the food and beverage processing and storage in Angola, the main subsectors that participate in these activities are the centralized systems, condensing units and even chillers mainly for the industrial (processing) and commercial (storage) sectors in Angola. The main refrigerant in these subsectors is R-404A, due to the availability and knowledge to use these technologies based on such refrigerant.
10. In Angola, the industrial sector is predominantly oriented toward mining and oil production, and secondarily toward food management processes. In the first case, large installations and operations require very specific sizes of refrigeration systems and, in many cases, very high pressures and very low temperatures. As a result, the use of low-GWP HFC alternatives is considered not convenient for this particular sector at this time."
11. .
12. On the latter case, for purposes of facilitate the analysis and due to the very close characteristics, these installations, in our case were classified within centralized systems, particularly as the most critical operations are concentrated in storage and handling zones. It is also noteworthy that in larger facilities, such as meat processing plants, ammonia has remained

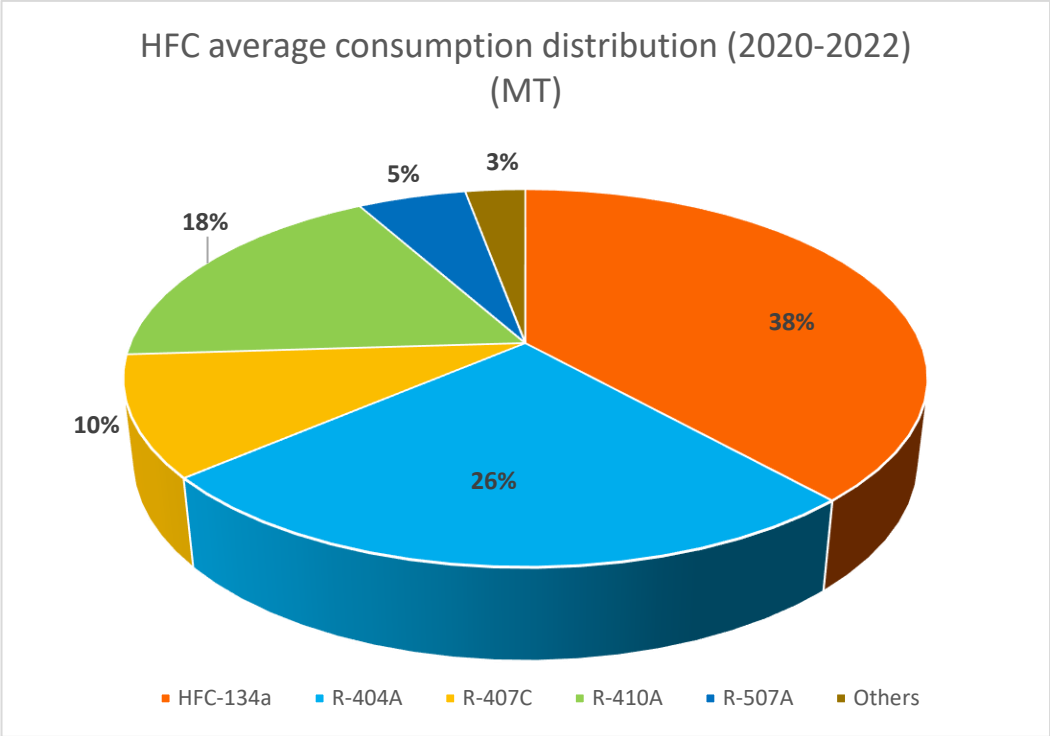
the principal refrigerant for several years. This preference has persisted over time, with no significant shift in refrigerant selection.

Installed capacity of HFCs in the commercial/industrial refrigeration sector (2024)

Total refrigerant installed in commercial refrigeration systems (MT)				
Technology	**R-134a**	**R-404A**	**R-507A**	**Total**
Stand-alone equipment	515			515
Centralized systems	429	4,290	1,650	6,369
Total	**944**	**4,290**	**1,650**	**6,884**

Source: Kigali PRP .

13. As shown in the table above, commercial/industrial refrigeration is the main overall user of HFCs, which means that there is a large potential for reducing HFC consumption; however, alternatives with lower global warming potential and higher energy efficiency are either not fully available or the capital cost is very high which represent a challenge for the implementation of the KIP.
14. Due to the installed capacity and the growth trend of the Angolan economy, a future increase if no alternative solutions are introduced and no promotion and test of alternatives it could be experimented and increase in the medium and long term in a BAU scenario, with a possible risk scenario of non-compliance.



Average consumption of HFC (2020-2022) by type of HFC

15. Under these conditions, it is very important to promote the dissemination of low GWP alternatives such as natural refrigerants such as HC (R-290), CO2 (R-744) or Ammonia (R-717). These trends highlight the urgency of introducing alternative technologies that can

simultaneously reduce HFC consumption and improve energy performance. Low GWP based cold chambers represent one of the most promising pathways to achieve both objectives.

16. The proposed Project Preparation Request (PRP) targets an emissions-intensive segment of the RAC sector: centralized commercial and industrial refrigeration systems with high refrigerant charges and continuous operating profiles. By preparing a site-specific demonstration of low-GWP technologies, the PRP fills a clear gap that is not addressed by existing Stage I interventions.
17. While Angola acknowledges the financial constraints that may affect the timely deployment of advanced technologies, the government is prepared to maximize the use of currently available resources to initiate compliance measures. These early actions will serve as a foundation for future phases of implementation. In subsequent stages, Angola anticipates strengthening collaboration with regional and international partners, securing technical assistance, and expanding institutional capacity. This cooperative approach aims to accelerate the phasedown of HFCs within the RAC sector and to ensure a durable and impactful transition aligned with global climate goals.

Objective

18. The selected beneficiary company, Angoalissar has expressed interest in replacing one existing R-404A-based cold chamber. The annex 1 presents the company's basic information.
19. This project will prepare a full demonstration project for the installation and operation of an energy-efficient cold chamber using a R-290/R-744 (propane/CO_2) cascade system in a selected food storage facility in Angola, to replace an existing R-404A based cold chamber refrigeration system. The potential cold chambers are included in Annex 2.
20. Angolissar will co-finance equipment, civil works and necessary modifications needed to adopt the new system in their plant.

Scope of Activities

21. Technical Diagnosis and Baseline Establishment

- Detailed Refrigerant Audit: Quantification of the R-404A charge in the existing system to be replaced.
- Energy Baseline: Detailed analysis of data logging to establish pre-project energy consumption for the cold chamber.
- Cooling Load: Obtainment of data or calculation of the thermal load for the chamber based on its volume, insulation, product intake, and local climate, specifically for maintaining temperatures of -15°C to -20°C.
- Site and Safety Assessment: Evaluation of the machinery room, electrical infrastructure, and safety requirements for installing an R-290/R-744 cascade system, focusing on the confined R-290 charge and the high-pressure R-744 circuit.

22. Technical and Economic Evaluation

- Preliminary Design: Preliminary sizing and specification of the R-290/R-744 cascade system, including the high-stage R-290 circuit, the cascade heat exchanger, and the low-stage R-744 circuit (e.g., pumped or direct expansion) serving the freezer evaporators.
- Technology and Component Sourcing: Identification of suitable suppliers for key components (e.g., R-290 compressors, CO_2-rated evaporators, cascade heat exchangers, and controls) and an assessment of import logistics.
- Cost-Benefit Analysis: Preliminary cost estimation (CAPEX) for the cascade system and projection of operational savings (OPEX) based on improved energy efficiency.

23. Co-financing Confirmation: Finalizing the financial contribution from the beneficiary company for the new system and associated works.

Expected Results

24. Defined technical scope and cost envelope for the demonstration project involving the replacement of an existing R-404A system with an integrated R-290/R-744 cascade refrigeration system, based on the actual size and configuration of the beneficiary's frozen food storage facility.
25. Preliminary cost estimates established for capital investment, installation, commissioning, and start-up of the R-290/R-744 system, enabling determination of the funding level required for the full demonstration project.
26. Assessment of the beneficiary's co-financing capacity completed, with formal agreement on co-financing the refrigeration equipment and undertaking all necessary civil works and plant modifications.
27. Established refrigerant and energy baselines for the potential cold chambers, including quantification of the existing R-404A charge and historical electricity consumption, to enable pre- and post-replacement performance comparison.
28. Validated cooling demand calculations for the freezing chamber, taking into account the specific requirements for storing frozen food at -15°C to -20°C under local ambient conditions.
29. Preliminary engineering design completed for the proposed R-290/R-744 cascade system, including:
- High-temperature R-290 circuit configuration.
- Low-temperature R-744 circuit layout.
- Preliminary sizing of compressors, cascade heat exchanger, evaporators, and piping.
30. Safety and site suitability assessment finalized, confirming requirements for:
- Machinery room ventilation and safety controls for the R-290 circuit.
- High-pressure safety considerations for the R-744 circuit.
31. Detailed preliminary costing (CAPEX and OPEX) prepared, covering equipment procurement, importation, civil works, installation, commissioning, and operational implications.
32. Implementation plan developed for the full demonstration project, including timeline, roles, and responsibilities.
33. Replicability roadmap developed, outlining how the demonstrated R-290/R-744 cascade technology can be scaled up across other cold storage facilities and centralized supermarket systems in Angola.

26. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (US $)	Bilateral/implementing agency
International/national technical consultancy to conduct technical feasibility assessment and prepare the full pilot proposal	20,000	UNDP
Site visits to candidate facilities, collection of refrigerant and energy consumption data, cooling load assessment, preliminary engineering review, and data logging for baseline energy performance	5,000	UNDP

Consultation with selected beneficiaries, technical experts, and relevant authorities to validate technology options, and finalize the pilot design concept.	5,000	UNDP
TOTAL	30,000	

ANNEX 1: Basic Information about the beneficiary company, Angoalissar

ANGOALISSAR

ANGOLA'S **LARGEST** FOOD **DISTRIBUTOR**

Angoalissar was **established in 1992** and, through its relentless effort, ambition, and professionalism, became one of **Angola's largest food distributors** and the founding force behind the industrial ecosystem that powers our Group. The company has played a critical role in securing Angola's food supply during moments of crisis — including the civil war and, more recently, the COVID-19 pandemic — standing firmly alongside the Government.

With **over 2,000 employees**, a **nationwide fleet, and operations across 11 provinces,** Angoalissar has become a reference of **scale, reliability, and national reach in Angola's food sector.** In 2024, it was **recognized by the General Tax Administration (AGT)** as the country's top corporate tax contributor, a testament to its integrity, impact, and long-term commitment to Angola's economic development.

In addition to household brands like **L' Aigle du Nord, Madrugada, Santa Clara, Patriota, Biba, Primavera, and Uncle Sam (rice),** the company distributes a wide portfolio of renowned international names including **Seara, Sibiou, Danone, Red Bull, Gallo, Jumbo, Pringles, Vaca que Ri, and Arcor.** Through **Kamba Express — Angola's first B2B digital platform** — it is transforming the wholesale distribution landscape.

Angoalissar is more than a distributor — **it is a driver of national industrialization.** Its logistics needs gave rise to flour mills, dairy plants, pasta factories, confectionery units, oil refineries, and soap production facilities — ensuring secure supply chains and reinforcing Angola's food sovereignty.

As a **long-standing partner of the Angolan Government,** the company generates thousands of indirect jobs, stimulates local value chains, and operates with a long-term vision and strong social purpose.

+2,000
EMPLOYEES
COLABORADORES

41
SALES POINTS
PONTOS DE VENDA

25,000 T
COLD STORAGE
ARMAZENAMENTO DE CONGELADOS

30,000 m²
LOGISTICS CENTER
CENTRO LOGÍSTICO

ANNEX 2 : Pre-selected Cold Chambers for the project at Angoalissar

City	Site	Room/Function	Number of Compressors	Compressor information	Refrigerant	Power HP	Power KW	estimated_charge (kg
Cabinda	Wh Mbaca	Cold storage room (freezing)	4	Danfos 4 x 12 Hp	R-404 A	48	35.81	28.80
Cabinda	Wh Lombo Lombo	Cold storage room (freezing)	2	Danfos 2 x 12 Hp	R-404 A	24	17.90	14.40
Cabinda	Wh Pio	Cold storage room (freezing)	4	Danfos 2 x 12 Hp	R-404 A	24	17.90	14.40
Benguela/Lobito	Wh Central Lobito	Cold storage room 1 (freezing)	6	Copeland 30 Hp	R-404 A	180	134.28	108.00
Benguela/Lobito	Wh Central Lobito	Cold storage room 2 (freezing)	6	Copeland 30 Hp	R-404 A	180	134.28	108.00

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Preparatory activities for a pilot project on energy efficient, low-GWP refrigeration systems in public fish markets and landing sites in Barbados	
Country:	Barbados	
Lead implementing agency:	UNDP	
Implementation period for the energy efficiency project:	36 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Servicing	30,000 USD

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

F. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

27. Agency:	UNDP
28. Sector:	Refrigeration
29. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2024 ☐ **No**
30. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter _____ ☐ **No** ☒ **N/A**
31. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No** ☒ **N/A**
32. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the	The project will directly contribute to Barbados' strategy to integrate HFC phase-down with national energy efficiency objectives.

final KIP will be submitted (decision 87/50(e))	

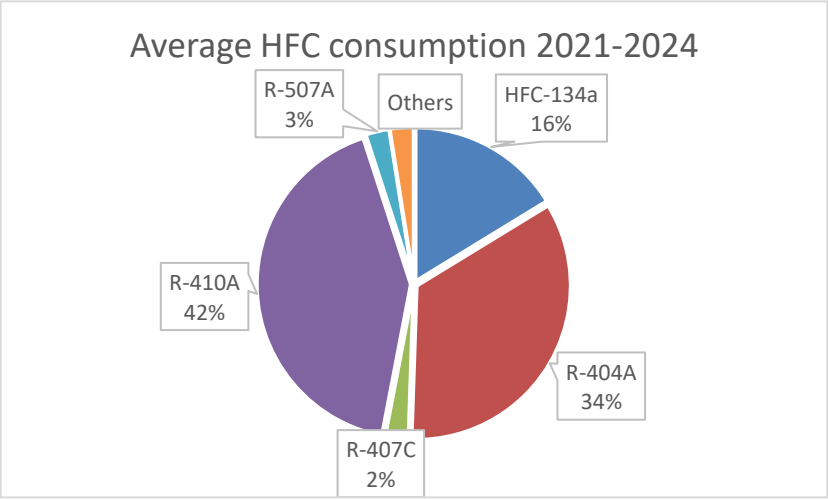
33. Project Description

Background and Rationale

1. Barbados acceded to the Montreal Protocol in 1992 and has consistently met its obligations to phase out ozone-depleting substances. On 19 April 2018, Barbados ratified the Kigali Amendment, committing to the phasedown of HFCs widely used in the refrigeration and air-conditioning (RAC) sector.
2. Between 2021 and 2024, Barbados recorded an average HFC consumption of 73.37 metric tonnes, equivalent to 166,762 CO_2-eq, with commercial and industrial refrigeration refrigerants (R-404A, R-507A and part of HFC-134a) representing approximately 37% of total consumption.

The following table and graph show the average consumption per substance:

Average Consumption 2021-2024			
Substance	**MT**	**CO2eq.**	**%**
HFC-134a	18.98	27,138	16.3%
R-404A	14.57	57,137	34.3%
R-407C	2.33	4,128	2.5%
R-410A	33.54	70,009	42.0%
R-507A	1.05	4,165	2.5%
Others	2.91	4,186	2.5%
TOTAL	**73.37**	**166,762**	**100.0%**



3. This highlights the importance of addressing high-GWP refrigerants in the fisheries sector, which is entirely dependent on the cold chain—from ice production at landing sites to cold storage for local consumption and export.
4. The linkage between these international protocols and the local fisheries sector is critical yet often overlooked. The fisheries value chain is entirely dependent on the cold chain from ice production at landing sites to cold storage for local consumption and export. As Barbados transitions away from Hydrochlorofluorocarbons (HCFCs) and HFCs under the Kigali

Amendment, the fisheries sector faces a dual challenge, namely, it must replace aging and energy inefficient that utilise high Global Warming Potential (GWP) refrigeration infrastructure with ozone and climate friendly and energy efficient alternatives without compromising food safety or economic viability.

5. The fisheries sector is a cornerstone of Barbados' "Blue Economy," contributing significantly to food security, livelihoods, and cultural heritage.

    - Economic Impact: The sector supports an estimated 8,800 livelihoods directly and indirectly, including fisherfolk, vendors, processors, boat builders and RAC technicians.
    - Food Security: Fish remains a primary source of protein for the population and a critical commodity for the tourism sector.
    - Vulnerability: Despite its importance, the sector is highly vulnerable to external shocks, including impacts on climate change like sargassum influxes and intensifying tropical cyclones.

6. This project is exceptionally timely given the devastation caused by Hurricane Beryl on July 1, 2024. The hurricane inflicted severe damage on the fisheries sector, with over 200 fishing vessels damaged or destroyed and significant structural damage to the Bridgetown Fisheries Complex (including the breakwater, jetties, fuel docks and market facilities).
7. This project complements the ongoing recovery efforts by ensuring that the "*Build Forward Better*" approach extends to the refrigeration and cold chain infrastructure. As the sector rebuilds, there is a narrow window of opportunity to ensure that new ice machines, cold storage units, and vessel refrigeration systems are energy-efficient and Kigali-compliant (using low-GWP refrigerants).

<u>Background and conditions of the Project</u>

8. Barbados' fisheries sector is a cornerstone of national food security, livelihoods, and cultural identity. The sector supports 8,800 livelihoods, supplies the tourism industry and remains a primary source of protein for the population. However, the cold chain that underpins this value chain is severely outdated, energy-inefficient and heavily dependent on high-GWP refrigerants. Much of the equipment is not fit for purpose, creating bottlenecks and operational challenges that heighten the risk of product quality deterioration and results in substantial economic losses.

9. Across 6 Public Seafood Markets, 5 Fish Landing Facilities, and 4 tertiary sites, the following systemic issues are present:

    - Only 3 markets have cold storage facilities that are functioning
    - Ice machines exist only at the 6 markets, forcing 9 other sites to transport ice
    - Several key facilities have inoperative or missing equipment (Bridgetown, Speightstown, Consett Bay, Oistins)
    - Vendors rely on non-refrigerated display cases, increasing spoilage risk
    - Temperature control is inconsistent and unmonitored
    - Energy consumption is high due to aging compressors and poor insulation

The situation was further exacerbated by Hurricane Beryl (July 2024), which caused severe damage to the industry as stated before.

10. As Barbados rebuilds, there is a narrow window to avoid technology lock-in of obsolete, high-GWP equipment. Without targeted intervention, the urgent replacement of damaged

systems risks locking the sector into another generation of inefficient, high-emission technologies.

The project aligns with:

- Kigali Amendment obligations
- HPMP Stage II
- Barbados National Cooling Strategy (2022)
- ExCom Decision 91/65 (Energy Efficiency Window)
- ExCom Decision 89/6 (MEPS and energy labelling integration)

However, critical data gaps prevent Barbados from preparing a full project proposal. The data gaps identified include::

- No complete RAC inventory exists for the 13 facilities
- Energy consumption of existing equipment is unknown
- Ice demand patterns are poorly documented
- No technology options analysis has been conducted
- No gender-responsive assessment exists for vendors and processors
- No cost-benefit or emissions reduction estimates are available

Accordingly, it is anticipated that this PRP will address these gaps.

Purposes of the project

- Demonstrate the performance of low-GWP refrigeration technologies (R290, Amonia, CO_2) in fisheries infrastructure.
- Improve energy efficiency in ice production, cold storage, and display systems.
- Reduce dependence on high-GWP refrigerants and inefficient legacy equipment.
- Strengthen capacity of RAC technicians in safe handling of flammable refrigerants.
- Introduce digital controls for temperature, door openings, and energy optimization.
- Explore renewable energy integration (solar) for high-load equipment.
- Provide a replicable model for other sectors (supermarkets, hotels, processors)

Expected results

- A complete technical baseline for the fisheries cold chain
- A prioritized replacement plan for low-GWP, energy-efficient equipment
- Demonstrated feasibility of natural refrigerants in public facilities
- Strengthened national capacity for safe handling of R290, Amonia and/or CO_2
- A full project proposal aligned with ExCom Decision 91/65
- A replicable model for the private sector (processors, supermarkets, hotels)
- Improved food safety and reduced post-harvest losses
- Gender-responsive recommendations for women vendors and processors

Scope of Activities

Project Inception and Coordination

- Inception meeting with the ODS & HFC management program and the Fish Markets and Fisheries Divisions, MENBF.
- Confirmation of 13 sites
- Development of fieldwork schedule

Collection of Background Information

- Review of national cooling strategy, HPMP II, and energy tariffs
- Compilation of existing inventories and maintenance logs

Field Assessments and Technical Data Gathering

- Site visits to 13 facilities
- RAC inventory (ice machines, chillers, freezers, display cases, AC units)
- Energy consumption assessment
- Ice demand study
- Safety and compliance review

Stakeholder Consultations

- Development of a stakeholder engagement strategy and plan
- Interviews with site/facility managers/supervisors, maintenance technicians, vendors, processors, fisherfolk and technicians.
- Gender-responsive needs assessment

Technical Options Analysis

- Evaluation of low-GWP alternatives (R290, CO_2, R600a)
- Preliminary sizing of replacement systems
- Assessment of solar integration feasibility

Development of the Full Project Concept

- Drafting of objectives, components, and expected outcomes
- Estimation of energy savings and emissions reductions
- Monitoring and verification framework

Budgeting and Financial Planning

- Market research for equipment needs
- Costing of equipment, installation, training, and logistics
- Identification of co-financing opportunities

Validation and Finalization

- Presentation of draft to national stakeholders
- Incorporation of comments
- Finalization for submission to the MLF Secretariat

Primary Institutional Beneficiaries

- Fisheries Division, Ministry of Environment and National Beautification and Fisheries (MENBF)
- ODS & HFC Management Programme
- Public Seafood Markets (6)
- Fish Landing Facilities (5)
- Tertiary landing sites (4)

Sectoral Beneficiaries

- Fisherfolk (predominantly men)
- Vendors and processors (predominantly women), supermarket and hotels
- RAC technicians and training institutions

Estimated equipment for full project:

The preliminary estimated budget for the final project will consider the following:

- Ice flakes machine ammonia-based system with capacity of 5-20 tonnes per day of ice flakes. This kind of system would allow to cover the requirements of a large-scale market and eliminating the HFC consumption but also reducing the energy consumption in a about 30 to 40% in comparison with an HFC system.
- Block ice machine Ammonia or R-290 based equipment with capacity of 5 to 10 tons/day for centralized ice production for distribution.
- Freezing tunnels small scale (500 to 1,000 kg/ hr) Ammonia based equipment. This kind of equipment is for rapid freezing fish products (whole or filets). The total of this equipment would be about 5 for different users.
- Training, capacity building, awareness, dissemination and project management.

An estimated 30% cofounding is expected. Once the assessment of the requirements of the market and the possibilities of co-funding, the final number and size of equipment will be defined.

34. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (US $)	Bilateral/implementing agency
International/national technical consultancy to conduct technical feasibility assessment and prepare the full pilot proposal	20,000	UNDP
Site visits to candidate facilities, collection of refrigerant and energy consumption data, cooling load assessment, preliminary engineering review, and data logging for baseline energy performance	5,000	UNDP
Consultation with selected beneficiaries, technical experts, and relevant authorities to validate	5,000	UNDP

technology options, and finalize the pilot design concept.		
TOTAL	30,000	

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Preparation for a pilot project focused on industrial refrigeration and heat pump applications that maintain or improve energy efficiency during HFC phase-down	
Country:	Belize	
Lead implementing agency:	UNDP	
Implementation period for the energy efficiency project:	36 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Servicing	30,000 USD

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

G. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

35. Agency:	UNDP
36. Sector:	Refrigeration
37. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2024 ☐ **No**
38. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter _____ ☐ **No** ☒ **N/A**
39. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No** ☒ **N/A**

40. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	The project will directly contribute to Belize's strategy to integrate HFC phase-down with national energy efficiency objectives.

41. Project Description

Background and Rationale

34. The poultry industry is a key agro-industrial sector in Belize, supplying most of the country's chicken meat and contributing significantly to food security, rural employment, and economic activity. Production is concentrated in a small number of vertically integrated operations that depend on continuous refrigeration and substantial hot-water use for processing and sanitation, making energy one of their major operating costs. The sector also relies on HFC-based refrigeration systems, although detailed information on refrigerant use and energy consumption remains limited. This context underscores the importance of improving energy performance and understanding current refrigerant practices to support long-term competitiveness and national climate commitments.
35. In this context, transitioning the poultry sector away from high-GWP refrigerants such as R-404A and toward integrated, low-emission HVAC and refrigeration technologies represents a significant opportunity for Belize. Such technologies can reduce the sector's CO_2-equivalent footprint while establishing a technical basis for high-efficiency thermal recovery that could be replicated across the broader agro-industrial landscape. Strengthening the sector's refrigeration and thermal systems in this way would reinforce both climate resilience and the operational sustainability of one of Belize's most vital food-production industries.

Sector background in Belize

36. To complement the qualitative and economic context described above, the following section presents the most recent quantitative data on HFC consumption in Belize, which provides the technical basis for understanding the relevance of the poultry sector within the national refrigeration landscape.

Distribution of HFC consumption by sector

37. The HFC consumption base on the year 2024, which is a more reliable consumption for the sectoral refrigerant use, and the most recent observation of the real consumption of refrigerants is considered, as shown in the following table and graphic:

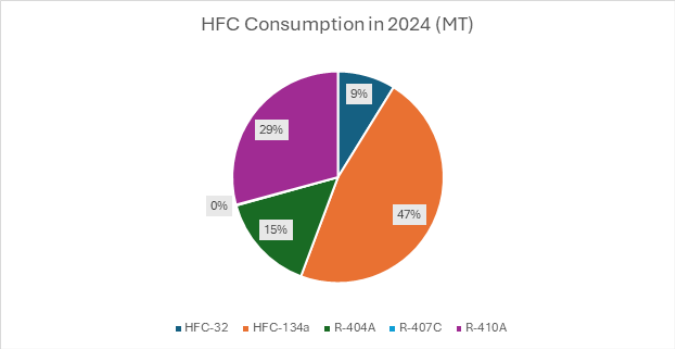
Table 1. HFC consumption in Belize in 2024 (MT)

Substance	Consumption in 2024 (MT)	% of total
HFC-134a	30.17	46.9
R-404A	9.65	15.0
R-407A	0.07	0.1
R-410A	18.78	29.2
HFC-32	5.68	8.8

TOTAL	64.35	100.00%

Source: National Ozone Office

Figure 1. HFC consumption in Belize in 2022 (MT)



38. Based on the information on the consumption of the year 2024, the HFC gases used in the refrigeration and air conditioning sectors, are shown in the following table:

Table 2. Consumption summary for refrigeration and air conditioning services, base year 2024 (MT)

Sector	Sub-Sector	R-134a	R-32	R-410A	R-407C	R-404A	R-507A	TOTAL
Air Conditioning	Domestic	0.00	0.28	7.36	0.07	0.00	0.00	7.71
	Commercial	0.00	5.39	11.04	0.00	0.00	0.00	16.44
Refrigeration	Domestic	2.11	0.00	0.00	0.00	0.00	0.00	2.11
	Stand alone	9.73	0.00	0.00	0.00	0.00	0.00	9.73
	Cold rooms medium size	1.42	0.00	0.00	0.00	1.90	0.00	3.32
	Cold rooms large size	0.66	0.00	0.00	0.00	0.69	0.00	1.35
	Centralized systems	0.00	0.00	0.00	0.00	5.50	0.28	5.78
	Condensing Units	0.58	0.00	0.00	0.00	0.69	0.00	1.26
	Chillers	1.08	0.00	0.38	0.00	0.00	0.00	1.46
Refrigerated transport	Reefer trucks	4.17	0.00	0.00	0.00	0.88	0.00	5.05
MAC		10.43	0.00	0.00	0.00	0.00	0.00	10.43
Total		30.17	5.68	18.78	0.07	9.65	0.28	64.63

Source: Own elaboration, from National Ozone Office

Industrial/Commercial refrigeration

39. In the food and beverage processing in Belize, the main subsectors that participate in these activities are the centralized systems, condensing units and even chillers mainly for the industrial (processing) and commercial (storage) sectors in Belize.

40. The main refrigerant in these subsectors is R-404A, due to the availability and knowledge to use these technologies based on such refrigerant. During the formulation of the KIP,

the technicians and users of these technologies, declared the easiness of handling a refrigerant that is "safe" and affordable.

41. Furthermore, the estimated installed capacity of HFCs in the centralized systems, condensing units and chillers sub-sectors in 2024 in MT is as follows:

Table 3. Estimated installed capacity of HFCs in the centralized systems, condensing units and chillers in 2024 (MT)

Sector	Sub-Sector	R-134a	R-410A	R-404A	R-507A	TOTAL
Refrigeration	Centralized systems	0.00	0.00	5.50	0.28	5.78
	Condensing Units	0.58	0.00	0.69	0.00	1.26
	Chillers	1.08	0.38	0.00	0.00	1.46
TOTAL		1.66	0.38	6.19	0.28	8.50

Source: own elaboration, from National Ozone Office

42. As shown in the table above, due to the installed capacity and the growth trend of the Belizean economy, a future increase if no alternative solutions are introduced and no promotion and test of alternatives it could be experimented and increase in the medium and long term in a BAU scenario, with a possible risk scenario of non-compliance.

43. Under these conditions, it is very important to promote conversion of the current disaggregated industrial processes and implementation of aggregated hot-cold processes called Heat Pumps by using natural refrigerants such as HC (R-290), CO2 (R-744) or Ammonia (R-717).

44. These trends highlight the urgency of introducing alternative technologies that can simultaneously reduce HFC consumption and improve energy performance. Integrated heat-pump systems represent one of the most promising pathways to achieve both objectives.

Justification of the PRP

45. The poultry industry is one of the most dynamic and strategically important agro-industrial sectors in Belize. It supplies the vast majority of the country's chicken meat and poultry products, forming a critical component of national food security and contributing significantly to rural employment and economic activity. Production is concentrated in a relatively small number of vertically integrated operations—ranging from medium-scale farms to fully industrialized processing plants—supported by a network of growers, hatcheries, feed mills, slaughterhouses, and cold-chain distribution centers. Preliminary national statistics indicate that the sector represents approximately 25–35% of the livestock subsector's GDP and provides over 70% of the animal protein consumed domestically. With annual production estimated between 35,000 and 45,000 metric tons, the sector's scale means that even incremental improvements in energy performance can translate into meaningful national-level impacts.

46. Poultry processing is one of the most energy-intensive agro-industrial activities in Belize. Facilities depend heavily on reliable refrigeration for chilling, freezing, storage, ice production, and temperature-controlled processing rooms, while simultaneously requiring substantial thermal loads for scalding, sanitation, and hot-water generation. These needs are currently met through separate systems—electrically powered refrigeration units and fossil-fuel-based

boilers—that operate independently and often inefficiently. This configuration increases operational costs and results in significant energy losses, as the heat rejected by refrigeration systems is not recovered or reused. Rising electricity costs, including proposed tariff adjustments by the Public Utilities Commission (PUC) for 2026 and a 35.5% surge in industrial demand in mid-2024, further threaten the sector's competitiveness.

47. At the same time, the poultry industry remains heavily reliant on high-GWP HFC refrigerants, particularly R-404A, with possible use of R-410A and residual HCFC-22 in older systems. However, Belize lacks detailed information on refrigerant distribution, installed cooling capacities, and energy consumption patterns across poultry facilities. This information gap limits the country's ability to design targeted, cost-effective interventions that simultaneously reduce HFC use and improve energy efficiency in line with its obligations under the Kigali Amendment.

48. Integrated heat-pump systems using low-GWP refrigerants offer a promising solution to these challenges. By simultaneously producing cold and heat from a single electrical input, these systems can recover thermal energy that is currently wasted, significantly increasing the overall coefficient of performance (COP) of industrial operations. International experience shows that such systems can reduce energy consumption by 30–50%, eliminate the need for fossil-fuel-based boilers, and provide a long-term, sustainable alternative to HFC-based refrigeration. For Belize, adopting this technology in the poultry sector could generate substantial operational savings, reduce greenhouse gas emissions, and create a replicable model for other poultry producers and other agro-industrial segments.

49. The PRP is therefore essential to generate the technical, economic, and environmental foundation required for a full demonstration project. Through site visits, refrigerant inventories, energy assessments, and engineering analyses, the PRP will identify suitable beneficiary facilities, quantify the potential for HFC reduction and energy savings, and develop a detailed implementation plan aligned with national priorities for climate mitigation, energy efficiency, and sustainable industrial development. Addressing current data gaps—such as refrigerant use, energy consumption profiles, engineering requirements, and cost-benefit analyses—will be critical to designing a robust, high-impact demonstration project capable of transforming energy and refrigerant management practices in Belize's poultry sector.

Project Description

50. The project consists of installing, as a pilot project, two medium-sized integrated heat pump for simultaneous cooling and heating using two different technologies based on a non-HFC refrigerant, preferably R-290 (propane), R-717 (NH3) or R-744 (CO2), or a combination of any of them. The objective is to demonstrate the viability of these technologies using natural refrigerants for industrial process applications. The system would replace both a heating system and a separate refrigeration system with an average cooling capacity from 300 kW to 500 kW, and containing a refrigerant charge of 200–500 kg of high-GWP HFCs.

51. The possible beneficiaries of this type of project are located in the animal protein industrial process sector, specifically in the poultry sector. The main current technology used in those applications is a separated process with heat and cold sides, managed independently with releases of heat, high use of energy for heating and cooling, and a leakage average of refrigerant of 35% per year within a useful life of 15 years. The reduction of mainly R-404A use contributes to a significative CO2eq emission mitigation in the RAC subsector, as well as a significant reduction of energy use (30% to 60%) by recovering the heat produced in the process.

52. In this sense, it is important to highlight that recent international experiences demonstrate that industrial heat pumps using natural refrigerants can deliver high energy performance in meat and poultry processing environments. Klinac et al. (2023) show that multi-level ammonia heat-pump integration in meat-processing facilities can reduce site emissions by more than 50% while significantly increasing overall system COP, confirming the suitability of NH_3-based high-lift systems for simultaneous heating and cooling demands. Industry case studies from GEA further report that ammonia heat pumps deployed in food-processing plants—including installations in warm and tropical climates—achieve up to 40% reductions in energy consumption and operating costs compared to conventional systems. Similarly, Copeland/Vilter industrial heat-pump applications in meat and poultry processing document substantial efficiency gains, with high-temperature NH_3 and CO_2 systems capable of halving energy use while providing stable hot-water production for sanitation. Together, these references confirm that natural-refrigerant heat pumps, including multi-stage and cascade configurations, are a technically proven solution for high-demand agro-industrial operations and offer a strong basis for replication in Belize's poultry sector.

Objective

53. To prepare a full demonstration project for the installation and operation of integrated heat pump systems in selected poultry processing facilities in Belize, through:
    - technical and energy assessments,
    - identification of suitable beneficiaries,
    - evaluation of refrigerant use and replacement potential,
    - and development of engineering, costing, and implementation plans

Scope of Activities

The PRP will include:

- Mapping of poultry processing facilities in Belize.
- Identification of refrigerants used (R-404A, R-410A, R-22, others).
- Technical evaluation of cold and heat demands.
- Energy consumption (electricity, gas or other fuels) assessments and its costs.
- Assessment of available technological options, with particular attention to their performance under Belize's climatic conditions and their ability to meet the poultry sector's specific cooling and heating requirements throughout the production cycle.
- Identification of candidate facilities for the demonstration project.
- Preliminary engineering and costing of integrated heat pump solutions.
- Assessment of co-financing capacity
- Development of the implementation plan for the full project.

Activities undertaken during the PRP

Market and Technical Diagnosis

- Mapping of poultry sector facilities.
- Estimation of refrigerant consumption and installed capacity.
- Identification of cold and heat processes.
- Energy consumption baseline.

Technical and Economic Evaluation

- Assessment of existing refrigeration and heating systems.
- Identification of integration opportunities.
- Preliminary engineering of heat pump solutions.
- Assessment of safety considerations for natural refrigerants
- Evaluation of grid capacity and electrical requirements
- Cost estimation for equipment, installation, and civil works.

Project Design

- Definition of system specifications.
- Drafting implementation timelines.
- Identification of co-financing contributions.
- Preparation of the full demonstration project document.

Expected Results

- Complete mapping of poultry facilities.
- Refrigerant consumption baseline.
- Energy consumption baseline.
- Technical feasibility assessments.
- Engineering pre-design of heat pump systems.
- Cost estimates for 2–3 demonstration sites.
- Full project proposal for submission to the ExCom.

Conditions for Implementation of the Future Demonstration Project

The full project (to be designed during the PRP) must:

- Be replicable across poultry facilities of different sizes.
- Replace significant quantities of HFCs currently used in refrigeration.
- Demonstrate energy efficiency improvements of at least 30–50% compared to separate refrigeration + boiler systems as mentioned above.
- Reduce or eliminate the use of fossil fuels for heating.
- Improve operational costs and competitiveness of the poultry sector.
- Align with the national HFC phase-down strategy under the Kigali Amendment.

Initial Cost Estimation

21- To estimate the average cost of the possible individual project or projects, it has to be considered the size of plant to be converted, mainly considering the energy consumed and the use of refrigerants, each plant has an energy consumption level which can be identified as medium-low, medium and medium high, where the majority of the possible plants that could be candidates to be converted to this kind of technology are. Then in that regard the initial cost estimation can be summarized in the following table:

Table 4. Costing basis for estimating the average level of funding per installation based on thermal load and costs of Heat pumps for each range of energy use (US$)

Thermal load range in refrigeration kW	Capital costs, USD	Installation & start up, USD	Engineering project cost, USD	Estimated HFC savings, kg	Estimated energy savings, %
300	400,000	200,000	13,000	300 to 600	30% to 60%
500	500,000	250,000	13,000	600 1,000	

22. The estimated costs for a medium size HPs (between 300 to 500 kW capacity) allow the definition of the level of funding that would be requested to cover the capital costs, installation, commissioning and start up.
23. Additionally, regarding the cost of the installation of the Heat-Pumps, the costs of planning, coordination, implementation, training, monitoring and promotion of the results of the project should be added; this would increase in the range of US$ 100,000 to 130,000, depending on the size of the best option or options of HP sizes.
24. These values will be refined during the PRP once detailed engineering assessments and site-specific requirements are identified.

Selection Process of Potential Beneficiaries (to be conducted during PRP)

The PRP will:

- Compile a directory of poultry processing facilities (slaughterhouses, processors, cold stores).
- Conduct initial outreach and information requests.
- Apply a screening survey covering:
- production volume,
- refrigeration systems,
- refrigerants used,
- heating systems,
- energy consumption,
- willingness to co-finance.
- Conduct on-site visits to shortlisted facilities.
- Evaluate technical feasibility and replicability.
- Select 2–3 candidate facilities for the full demonstration project.

42. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (US $)	Bilateral/implementing agency
International/national technical consultancy to conduct technical feasibility assessment and prepare the full pilot proposal	20,000	UNDP
Site visits to candidate facilities, collection of refrigerant and energy consumption data, cooling load assessment, preliminary engineering review, and data logging for baseline energy performance	5,000	UNDP

Consultation with selected beneficiaries, technical experts, and relevant authorities to validate technology options, and finalize the pilot design concept.	5,000	UNDP
TOTAL	30,000	

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Preparation for a pilot project to maintain and/or improve the energy efficiency of replacement technologies and equipment in the context of HFC phase-down: demonstration project for the use of low-GWP refrigerant in the commercial and industrial refrigeration sector	
Country:	Cambodia	
Lead implementing agency:	UNDP	
Implementation period for the energy efficiency project:	36 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Servicing	30,000 USD

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

H. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

43. Agency:	UNDP
44. Sector:	Refrigeration
45. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2025 ☐ **No**
46. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter _____ ☐ **No** ☒ **N/A**
47. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No** ☒ **N/A**

48. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	The project will directly contribute to Cambodia's strategy to integrate HFC phase-down with national energy efficiency objectives.

49. Project Description

Background and Rational

1. Cambodia is experiencing steady growth in its refrigeration and air-conditioning (RAC) sector as a result of economic expansion, urbanization, tourism development, and increasing demand for food preservation and cold-chain logistics. While a substantial share of hydrofluorocarbon (HFC) consumption is concentrated in mobile and residential air-conditioning, the sectoral survey conducted during preparation of Stage I of Cambodia's Kigali HFC Implementation Plan (KIP) highlights the strategic importance of centralized refrigeration and chiller systems.

2. In 2022, chillers consumed 35.65 metric tonnes of HFCs, primarily HFC-134a and R-410A, corresponding to approximately 56,062 tonnes of CO_2-equivalent emissions. Cold storage and industrial refrigeration accounted for 9.27 metric tonnes, almost entirely R-404A and R-507A, generating approximately 36,379 tonnes of CO_2-equivalent emissions. These applications are characterized by high refrigerant charge sizes, centralized system configurations, continuous operation, and long equipment lifetimes, often exceeding 15 to 20 years.

3. Cold storage and industrial refrigeration systems in Cambodia typically operate under high ambient tropical conditions, frequently exceeding 35°C. These systems require high compression ratios and consume significant electricity, with energy costs representing a major share of operating expenses. Leakage rates in centralized systems are generally higher than in factory-sealed equipment due to extended piping networks and servicing practices. The R-404A use has also been increasing, particularly as older HCFC-22 systems are replaced. This trend creates a risk of long-term lock-in of high-global-warming-potential (GWP) technologies at a time when Cambodia must progressively reduce HFC consumption in line with Kigali Amendment obligations.

4. Transcritical carbon dioxide (CO_2, R-744) systems provide a technically mature, low-GWP alternative for centralized refrigeration and certain chiller applications. Modern transcritical systems operate at higher pressures and employ advanced technologies such as parallel compression, gas ejectors, adiabatic gas coolers, and optimized electronic controls. These features have significantly improved performance in warm and high-ambient climates.

5. For larger industrial cold storage facilities with very high cooling loads, ammonia-CO_2 cascade systems may also represent a technically appropriate configuration. In such systems, ammonia is typically confined to a machine room on the high-temperature side, while CO_2 is used in occupied spaces on the low-temperature side, thereby reducing ammonia charge and enhancing operational safety. Compared with conventional HFC-based refrigeration systems, ammonia-CO_2 cascade technologies offer higher cooling capacity and improved energy performance at low temperatures.

6. International experience over the past decade demonstrates that properly engineered transcritical CO_2 systems and ammonia-CO_2 cascade systems can achieve energy savings in the range of 15 to 25 per cent compared to conventional HFC rack systems in continuous-load applications such as cold storage. In addition to eliminating direct refrigerant emissions associated with high-GWP HFCs, these systems offer stable long-term operating costs due to the low price and availability of CO_2 and ammonia. For facilities with high annual electricity consumption, improved system efficiency translates into measurable economic benefits.

7. Despite the maturity of these technologies globally, the adoption of these systems in Cambodia is still very limited. Local contractors and service technicians have limited experience operation these systems, and potential investors lack confidence in the absence of local performance data under

Cambodian climate conditions. Demonstrating these low-GWP technologies in the commercial and industrial refrigeration sector at this stage would therefore close an important technical and market gap.

Status of implementation of energy efficiency-related activities funded by the Multilateral Fund

8. Cambodia ratified the Kigali Amendment on 8 April 2021, with HFC import quota system came into force on 1 January 2024. The KIP (stage I, first tranche) was approved at the 93rd ExCom in 2023.

9. Under Stage I of the Kigali HFC Implementation Plan (KIP), Cambodia is going to demonstrate six (6) R-290-based condensing units and assess their energy performance. While this represents an important step in introducing natural refrigerants, the scope does not extend to centralized rack systems or large-capacity cold storage and chiller installations operating with high-charge R-404A or HFC-134a. These larger systems involve significantly higher refrigerant quantities, more complex system architecture, and greater long-term emission and energy implications. As such, they require a distinct technical assessment and demonstration pathway.

10. At the 94th meeting, the Executive Committee approved additional activities under decision 89/6(b) to maintain energy efficiency in the RAC servicing sector. That project focuses on regulatory development, Minimum Energy Performance Standards (MEPS) for air-conditioners, labelling, customs training, and servicing-sector capacity building.

11. This proposed PRP is therefore fully complementary and does not duplicate the above approved energy efficiency-related activities. Instead, it addresses a different segment of the sector—large, high-charge refrigeration systems—through preparation of a site-specific demonstration of low-GWP technologies.

12. Early demonstration of transcritical CO_2 or ammonia-CO_2 systems in Cambodia is strategically important to prevent further installation of high-GWP R-404A systems that may remain operational through the 2035–2045 reduction steps under the Kigali schedule. Generating domestic technical experience and performance evidence will reduce perceived risk, support informed investment decisions, and facilitate future replication in cold storage, industrial processing and large commercial applications.

Objective

13. The objective of the proposed project preparation request is to identify and technically assess two pilot sites in the cold storage or chiller subsector operating centralized high-GWP HFC systems and to prepare a fully developed demonstration project proposal for their conversion to transcritical CO_2 systems, or where technically justified based on facility scale and configuration, ammonia–CO_2 cascade systems.

Scope of Activities

14. The project preparation will focus on targeted technical assessment and proposal development.

15. A structured screening of centralized refrigeration and chiller installations will be conducted to identify facilities operating R-404A, R-507A, HFC-134a or R-410A systems with significant refrigerant charge sizes. Candidate facilities will be evaluated based on technical suitability, refrigerant consumption, energy profile, system age, and willingness to participate with co-financing.

16. Two pilot beneficiaries will be selected for detailed technical assessment. For each facility, site visits will be conducted to collect baseline data on refrigerant charge, system configuration, cooling load, and electricity consumption. Technical feasibility of installing a transcritical CO_2 system, or where appropriate for very large industrial applications, an ammonia-CO_2 cascade system, will be evaluated, including space requirements, integration constraints, safety considerations, and local capacity requirements.

17. Based on technical assessments, conceptual system designs will be developed for each pilot site. Preliminary capital cost estimates will be prepared, and expected energy savings will be calculated based

on load characteristics and climate conditions. Refrigerant-related CO_2-equivalent emission reductions will be estimated as well.

18. The final output of the PRP will be a complete and costed pilot demonstration proposal ready for submission to the Executive Committee.

Expected Results

19. The project preparation is expected to deliver:

- Identification and confirmation of two suitable pilot beneficiaries;
- Baseline technical and energy performance data for both facilities;
- Conceptual system designs and preliminary cost estimates and incremental cost analysis;
- Estimated energy savings and greenhouse gas emission reductions;
- A draft pilot proposal for consideration by the Executive Committee.

50. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (US $)	Bilateral/implementing agency
International/national technical consultancy to conduct technical feasibility assessment and prepare the full pilot proposal	20,000	UNDP
Site visits to candidate facilities, collection of refrigerant and energy consumption data, cooling load assessment, preliminary engineering review, and data logging for baseline energy performance	5,000	UNDP
Consultation with selected beneficiaries, technical experts, and relevant authorities to validate technology options, and finalize the pilot design concept.	5,000	UNDP
TOTAL	30,000	

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Preparatory Activities for a Pilot Project on Energy-Efficient, Low-GWP Cold Storage for Ethiopia's Horticultural Sector.	
Country:	Ethiopia	
Lead implementing agency:	UNDP	
Implementation period for the energy efficiency project:	36 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Servicing	30,000 USD

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

I. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

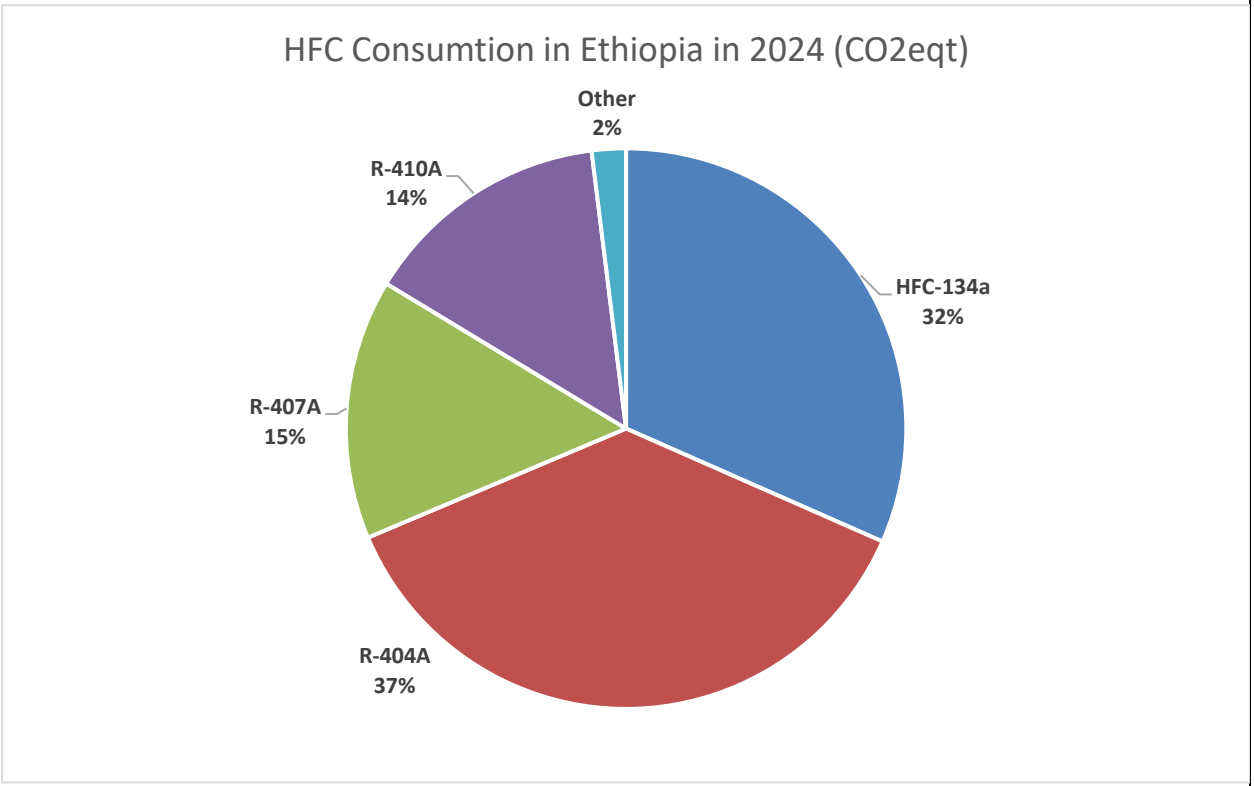
51. Agency:	UNDP
52. Sector:	Refrigeration
53. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2024 ☐ **No**
54. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter _____ ☐ **No** ☒ **N/A**
55. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No** ☒ **N/A**
56. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the	The first stage of KIP for Ethiopia was approved in the 97th ExCom meeting in December 2025, for the reduction of 10% of baseline. This project will

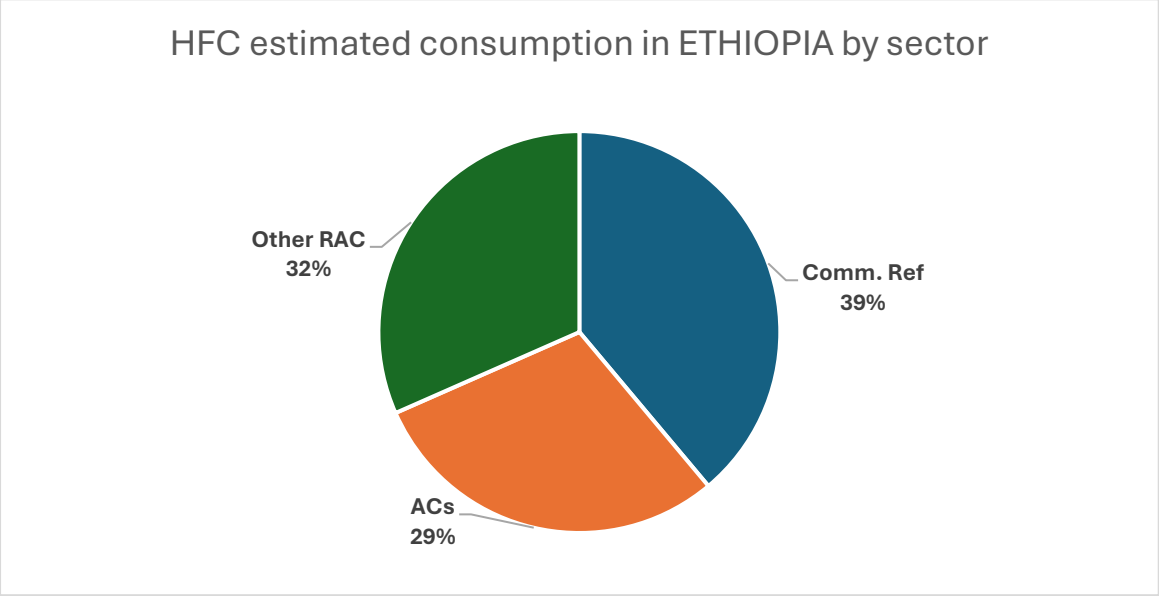
final KIP will be submitted (decision 87/50(e))	contribute to conduct the technology substitution in the commercial refrigeration sector, particularly in the cold rooms used in different markets and installations, promoting the reduction mainly of R-404A.

57. Project Description

Background information

The HFC consumption in 2024 in Ethiopia is 96.00 MT, of which 18.08 MT were of R-404A, 0.14 MT of R-507A and 0.44 of R-508B, those are the main refrigerants used in cold storage chambers for many subsectors in the commercial refrigeration sector. In terms of climate impact, the total consumption of HFC is 203,519 CO2eqt, of which 74,456 CO2eqt are from R-404A, R-507A and R-508B. As a result, these refrigerants contribute to 38.1% of the total HFC consumption in the RAC sector.





Cold rooms servicing is a major consumer of the referred refrigerants market in Ethiopia. Therefore, demonstrating energy efficient, low-GWP technologies for cold rooms, especially in the vital horticultural sector focusing on cut flowers and vegetables, would have an important impact on the overall consumption of HFC, and on energy consumption.

Challenges and Opportunities

Existing cold rooms in Ethiopia typically feature:

- Older equipment with low energy efficiency.
- Use of high GWP refrigerants (e.g., R-404A).
- Deteriorated or poor thermal insulation.
- Basic controls and continuous operation without optimization.
- High electricity costs due to high rates and low efficiency, with high risks of energy disruption in rural areas.

Ethiopia's rural communities continue to face structural constraints in electricity access and reliability that directly affect the viability of cold chain systems. In many areas, grid supply is either unavailable or characterized by outages and voltage fluctuations, which compromise the performance of refrigeration equipment and contribute to post-harvest losses. Where electricity is available, end-user tariffs are relatively high and subject to variability due to pass-through components such as fuel cost and foreign exchange adjustments, increasing operational uncertainty for cold storage applications. In weak-grid contexts, reliance on diesel generators further raises costs and exposes operators to international oil price volatility. While public interventions, including targeted subsidies and lifeline tariffs, aim to improve affordability, they do not fully address underlying constraints related to supply reliability and infrastructure limitations. These conditions support a strong technical and economic case for deploying energy-efficient, low-GWP cold rooms designed for weak-grid operation, consistent with the objectives of the Kigali Amendment.

The integration of solar energy into cold rooms addresses both the reliability and cost challenges inherent to rural Ethiopia, offering an independent and sustainable power source that reduces dependence on the national grid and exposure to volatile energy prices. Finally, addressing mobility as an additional design consideration further extends the reach of this technology, enabling cold storage units to serve dispersed and hard-to-access communities across the country.

Beyond rural areas, the scalability of this approach is significant. The same technologies are readily applicable to distribution centres and urban markets in Ethiopia's cities and towns, broadening the potential user base across the entire agricultural cold chain. More importantly, demonstrated success stories in Ethiopia can serve as a replicable model across sub-Saharan Africa, where similar energy, climate, and food loss challenges are widely shared.

Project Objectives

The purpose of the preparatory project is to generate the technical, economic, and institutional baseline required to design a pilot demonstration project on energy-efficient, low-GWP cold storage in Ethiopia, in line with Decision 91/65. Specifically, the preparatory activities will: (i) establish a robust baseline of the cold storage sector, including refrigerant use, energy performance, and servicing practices; (ii) assess the technical feasibility, safety requirements, and market readiness of alternative low-GWP, energy-efficient technologies under Ethiopia's climatic and operational conditions; and (iii) identify key stakeholders, capacity gaps, and enabling conditions for implementation, including technician training needs and monitoring and verification (M&V) frameworks.

The preparatory project will culminate in the development of a comprehensive project proposal document for a pilot demonstration. This document will define the technology selection, system design specifications, implementation strategy, project sustainability and replicability for cold storage in the horticultural sector in Ethiopia and sub-Saharan Africa, and expected energy and climate benefits, supported by a clear M&V methodology.

The proposed demonstration project, to be developed under this preparatory phase, is expected to validate the performance, safety, and scalability of energy-efficient, non-fluorinated cold storage, while strengthening local technical capacity, introducing digital monitoring and performance tracking tools, and establishing a replicable model for broader adoption in Ethiopia and, where applicable, in other sub-Saharan African countries.

The overarching goal of the pilot demonstration project is to prove the technical and economic viability of energy-efficient, low-GWP cold storage technologies powered by renewable energy sources, thereby reducing Ethiopia's dependence on costly and supply-volatile oil-based electricity generation.

This project has the following specific purposes:

1. Demonstrate the performance of the new energy-efficient technology based on low-GWP refrigerants instead of HFC based technologies.
2. Demonstrate the safety of alternative technologies, considering the design, installation standards, refrigerant charge, and preventive maintenance programmes.

3. Quantify and document the energy efficiency gains of non-fluorinated refrigerant-based systems relative to existing installations, providing measurable evidence to support broader adoption.
4. Strengthen national capacity for the safe handling, installation, and servicing of non-fluorinated refrigerants among technicians, engineers, and relevant stakeholders in Ethiopia.
5. Consider the electronic controls of the new technology to enhance the efficiency of the already improved technology, with the purpose of minimising the energy consumption.
6. Install solar photovoltaic (PV) systems as the primary energy source for the demonstration units, reducing dependence on grid electricity and oil-generated power, and improving resilience against energy price volatility and supply disruptions.

Expected Outcomes

The preparatory phase will deliver a comprehensive, evidence-based characterization of the cold storage in horticulture sector in Ethiopia, including a detailed inventory of refrigeration equipment, refrigerant use, and operating conditions, together with a quantified baseline of energy performance and associated emissions. Based on this assessment, the PRP will develop a prioritized segmentation of equipment typologies and geographic locations, leading to the identification and justification of suitable pilot demonstration sites.

The PRP will further evaluate the technical, economic, and safety feasibility of deploying low-GWP, energy-efficient alternatives under local climatic conditions, infrastructure constraints, and servicing practices. This will include identification of regulatory, standards, and capacity gaps, as well as requirements for safe handling of flammable and high-pressure refrigerants.

In parallel, the preparatory phase will incorporate a gender-responsive assessment of the cold storage in horticulture sector to identify differentiated roles, barriers, and opportunities, and to inform inclusive capacity-building and implementation strategies.

The principal output of the PRP will be a fully developed, project proposal in line with Decision 91/65. This proposal will define the selected technologies, implementation modalities, cost structure, and monitoring and verification framework, and will articulate the expected impacts in terms of improved energy efficiency, reduced direct and indirect emissions, strengthened technical capacity, enhanced product safety, and reduced product losses, with clear potential for replication within Ethiopia and across similar sub-Saharan African contexts.

Key Deliverables

In addition to the Project Document, the following key deliverables will contribute to achieving the project's overarching outcome:

- Inventory of cold storage in the horticulture sector in Ethiopia
- Detailed evaluation for the baseline performance of selected sites
- Gender-responsive assessment of the cold storage in horticulture sector: identify differentiated roles, barriers, and opportunities, and to inform inclusive capacity-building and implementation strategies.

- Capacity building and knowledge transfer: empowering stakeholders to actively contribute to the advancement of energy efficiency in the sector.

Project Activities

Activity 1: Project Inception, Coordination, and Desk Review

Objective: Establish governance, confirm scope, and compile existing information.

Activities:

- Kick-off with the National Ozone Unit and relevant stakeholders (e.g., energy, and agriculture).
- Confirmation of target applications and candidate sites (e.g., rural horticulture aggregation centres).
- Review of national policies (KIP, energy tariffs, EE regulations, NCAP, NDC)
- Review of existing cold chain initiatives and donor programmes
- Development of workplan and field mission schedule.

Activity 2: Field Assessments and Baseline Characterization

Objective: Establish technical, operational, and energy baselines.

Activities:

Site visits for the selected locations for pilot demonstrations to assess:

- Existing cold rooms (or absence thereof)
- Refrigerant types, approximate charge, and servicing practices
- Equipment condition and insulation quality
- Collection of operational and energy data: electricity use (bills, estimates)
- Cooling demand profiles and usage patterns
- Identification of key inefficiencies, losses, and constraints.

Activity 3: Stakeholder Engagement and Needs Assessment

Objective: Ensure demand-driven design and identify implementation barriers.

Activities:

- Consultations with farmers' groups/cooperatives, facility operators and technicians, and government and private-sector stakeholders
- Identification of cooling requirements (capacity, temperature, mobility needs) and key barriers (cost, energy access, technical capacity)
- Assessment of training and servicing gaps.

Activity 4: Technical Options Analysis and Preliminary System Design

Objective: Define feasible solutions integrating low-GWP refrigerants, energy efficiency, renewable energy, and mobility.

Activities:

- Screening of technology options:
  - low-GWP refrigerants (e.g., HC-290, CO_2, NH3, or other technologies where applicable),
  - energy-efficiency measures (high-performance insulation, VSDs, efficient components, controls),
  - assessment of solar PV / hybrid integration feasibility, and
  - modular and mobile cold room concepts
- Preliminary sizing and configuration of systems for selected use cases
- Order-of-magnitude CAPEX estimates.

Activity 5: Project Formulation, M&V Framework, and Finalization

Objective: Develop a demonstration proposal aligned with Decision 91/65.

Activities:

- Definition of project components, outputs, and expected impacts.
- Quantification of:
  - Energy savings (kWh/year, indicative)
  - Emission reductions (direct and indirect)
- Development of monitoring, verification, and reporting (M&V) framework
- Preparation of implementation plan, training approach, and replication strategy
- Validation workshop with stakeholders and finalization for submission to the Multilateral Fund Secretariat.

Budget and timeline

A detailed budget is outlined in the table below. This PRP project is estimated to be implemented in 12 months. The follow-on EE project is estimated to be implemented in 24 months with an estimated budget of 350,000 USD. The full proposal is expected to demonstrate:

- Two mobile cold storage units powered using solar PV
- Two medium-size cold storage unit
- Digital monitoring systems in all cold storage units
- Management, training and awareness

58. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (USD)	Bilateral/ Implementing Agency
Inception, Coordination & Desk Review: Conduct a kick-off meeting with NOU and relevant stakeholder, perform relevant desk research on local and regional policies and initiatives, and develop a workplan.	5,000	UNDP
Field Assessments & Baseline: Visit selected demonstration sites (~3) and assess existing cold rooms (or absence thereof), refrigerant usage and servicing practices, equipment condition and insulation quality, and collect operational and energy data: electricity use (bills, estimates). Work with beneficiaries to	10,000	UNDP

identify cooling demand profiles and usage patterns and identify key inefficiencies, losses, and constraints.		
Stakeholder Engagement: Consult with farmers' groups/cooperatives, facility operators and technicians, and government and private-sector stakeholders on implementation plans. Identify cooling requirements and key barriers. Assess training and servicing gaps.	5,000	UNDP
Technical Analysis & Preliminary Design: Screen energy-efficient, low-GWP technology options and investigate solar PV / hybrid integration feasibility, and modular and mobile cold room concepts. Perform preliminary sizing and configuration of systems for selected use cases and obtain potential quotes for CAPEX requirements.	5,000	UNDP
Project Formulation & Finalization: Define project components, outputs, and expected impacts, quantifying energy savings and emission reductions. Development M&V framework and prepare an implementation plan. Define the training and capacity building approaches. And devise a replication strategy. Conduct a validation workshop with stakeholders and finalise submission to the Multilateral Fund Secretariat.	5,000	UNDP
TOTAL	**30,000**	**-**

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Preparatory Activities for a Pilot Project on Resilient, Solar-Powered Medical Cold Chain Infrastructure in Guinea-Bissau.	
Country:	Guinea Bissau	
Lead implementing agency:	UNDP	
Implementation period for the energy efficiency project:	36 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Servicing	30,000 USD

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

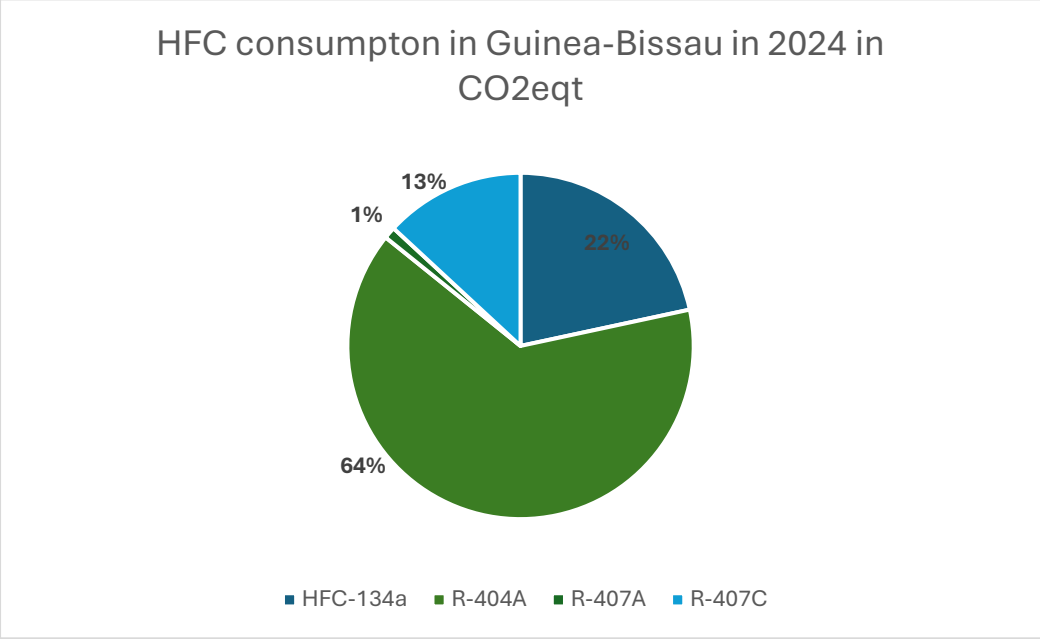
J. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

59. Agency:	UNDP
60. Sector:	Refrigeration
61. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2024 ☐ **No**
62. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter _____ ☐ **No** ☒ **N/A**
63. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No** ☒ **N/A**
64. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the	The first stage of KIP for Guinea-Bissau was approved in the 97th ExCom meeting in December 2025, for the reduction of 10% of baseline. This project will

final KIP will be submitted (decision 87/50(e))	contribute to conduct the technology substitution in the commercial refrigeration sector, particularly in the cold rooms used in different markets and installations, promoting the reduction mainly of R-404A.

65. Project Description

The HFC consumption in 2024 in Guinea-Bissau is 224.0 MT, of which 93.0 MT were of R-404A. In terms of climate impact, the total consumption of HFC is 568,511 CO2eqt, of which 364,709 CO2eqt is R-404A, representing about 64.2% of the country's total. This project therefore presents a strategic opportunity to reduce national HFC consumption while addressing a critical public health need.



Challenges and Opportunities

In Guinea-Bissau, a functional medical cold chain is fundamental to the nation's health system and is a matter of life and death. The efficacy of national immunization programs and the availability of life-saving medicines depend entirely on maintaining a continuous and precise temperature-controlled supply cold chain. However, the existing infrastructure faces critical challenges:

Unreliable Energy Supply: Frequent power outages and an unstable grid, particularly outside the capital, place the national stock of vaccines and medicines at constant risk of spoilage.

Aging Infrastructure: Many health facilities rely on older refrigeration units that are energy-intensive, prone to failure, and use high-GWP refrigerants.

Inadequate Temperature Control: Lack of precise digital monitoring and alarm systems means that temperature deviations can go unnoticed, rendering vaccines ineffective.

The “Last-Mile” Gap: The transportation of vaccines from regional centres to local health posts is a major vulnerability, often relying on inadequate containers that cannot guarantee temperature stability, especially given the high ambient temperatures.

Losses within the medical cold chain not only result in significant financial waste but, more importantly, lead to failed immunization campaigns and a lack of trust in the healthcare system. This project seeks to address these gaps by introducing resilient, energy-efficient low-GWP solutions. By aligning with the Kigali Amendment and leveraging solar power, the project will build a sustainable medical cold chain that strengthens national health security. All proposed technologies will be benchmarked against the World Health Organization’s (WHO) Performance, Quality and Safety (PQS) standards to ensure their suitability for this critical application.

Project Objectives

The purpose of the preparatory project is to generate the technical, economic, and institutional baseline required to design a pilot demonstration project on energy-efficient, low-GWP medical cold chain technologies in Guinea Bissau, in line with Decision 91/65. Specifically, the preparatory activities will: (i) establish a robust baseline of the medical cold chains, including equipment typologies, refrigerant use, energy performance, and servicing practices; (ii) assess the technical feasibility, safety requirements, and market readiness of alternative low-GWP, energy-efficient technologies (including HC-290 and R-744 systems) under Guinea-Bissau’s climatic and operational conditions; and (iii) identify key stakeholders, capacity gaps, and enabling conditions for implementation, including technician training needs and monitoring and verification (M&V) frameworks.

The preparatory project will culminate in the development of a comprehensive project proposal document for a pilot demonstration. This document will define the technology selection, system design specifications, implementation strategy, project sustainability and replicability in the medical cold chain sector in Guinea-Bissau and sub-Saharan Africa, and expected energy and climate benefits, supported by a clear M&V methodology.

The proposed demonstration project, to be developed under this preparatory phase, is expected to validate the performance, safety, and scalability of energy-efficient HC-290 and R-744 refrigeration systems in the medical cold chains, while strengthening local technical capacity, introducing digital monitoring and performance tracking tools, and establishing a replicable model for broader adoption in Guinea-Bissau and, where applicable, in other sub-Saharan African countries.

The specific purposes are:

1. Demonstrate the performance of WHO PQS-prequalified, natural refrigerant-based cold rooms and freezers in the context of a national medical supply chain.
2. Demonstrate the safe application of these technologies in health facilities, supported by robust installation standards and maintenance programs.
3. Quantify the energy savings and improved temperature stability achieved by the new systems.
4. Build national capacity among Ministry of Health technicians for the installation, operation, and maintenance of modern, natural refrigerant-based systems.

5. Pilot a comprehensive solution for “last-mile” distribution using high-performance, passively cooled cold boxes to ensure vaccine integrity during transport.
6. Install and validate solar PV systems with battery storage as the primary power source to guarantee uninterrupted operation.

Expected Outcomes

The preparatory phase will deliver a comprehensive, evidence-based characterization of the medical cold chain sector in Guinea-Bissau, including an inventory of equipment, refrigerant use, and operating conditions, together with a quantified baseline of energy performance and associated emissions. Based on this assessment, the PRP will develop a prioritized segmentation of equipment typologies and geographic locations, leading to the identification and justification of suitable pilot demonstration sites.

The PRP will further evaluate the technical, economic, and safety feasibility of deploying low-GWP, energy-efficient alternatives under local climatic conditions, infrastructure constraints, and servicing practices. This will include identification of regulatory, standards, and capacity gaps, as well as requirements for safe handling of flammable and high-pressure refrigerants.

In parallel, the preparatory phase will incorporate a gender-responsive assessment of the medical cold chain sector to identify differentiated roles, barriers, and opportunities, and to inform inclusive capacity-building and implementation strategies.

The principal output of the PRP will be a fully developed, project proposal in line with Decision 91/65. This proposal will define the selected technologies, implementation modalities, cost structure, and monitoring and verification framework, and will articulate the expected impacts in terms of improved energy efficiency, reduced direct and indirect emissions, strengthened technical capacity, enhanced vaccines and medicines safety, and reduced losses, with clear potential for replication within Guinea-Bissau and across similar sub-Saharan African contexts.

The key expected results for the full project are:

- The development of a scalable and replicable model for solar-powered medical cold rooms, freezers, and an associated last-mile transport system.
- A specialized training program for National Ozone Unit (NOU) staff, Ministry of Health technicians, and healthcare workers on the correct use, monitoring, and maintenance of the new cold chain equipment.
- A robust monitoring system to track equipment performance, temperature integrity, and system uptime, providing critical data for national health planning.
- An extensive dissemination program to share project outcomes with all regional health directorates, clinics, and international health partners (e.g., WHO, UNICEF, Gavi) to promote nationwide replication.

Key Deliverables

In addition to the Project Document, the following key deliverables will contribute to achieving the project’s overarching outcome:

- Analysis of medical cold chain in Guinea-Bissau
- Detailed evaluation for the baseline medical cold chain performance of selected sites
- Gender-responsive assessment of the medical cold chain sector to identify differentiated roles, barriers, and opportunities, and to inform inclusive capacity-building and implementation strategies.
- Capacity building and knowledge transfer: empowering stakeholders to actively contribute to the advancement of energy efficiency, access, and resilience in the sector.

Project Activities

Activity 1: Project Inception, Coordination, and Desk Review

Objective: Establish governance, confirm scope, and compile existing information.

Activities:

- Formal kick-off with the National Ozone Unit and Ministry of Public Health; confirmation of partners (e.g., WHO, UNICEF country offices); establish a technical working group.
- Confirmation of target applications and candidate sites (e.g., 2 local healthcare centres and 2 vaccine and/or medicine distribution centres).
- Review of national policies (KIP, energy tariffs, EE regulations, NCAP, NDC)
- Review the National Health Development Plan, immunization strategies, and existing cold chain inventories
- Compile data on vaccine spoilage rates and energy infrastructure at health facilities
- Development of workplan and field mission schedule.

Activity 2: Field Assessments and Baseline Characterization

Objective: Establish an accurate baseline of the existing medical cold chain including operational and energy data.

Activities:

- Site visits to various medical cold chain facilities: the central medical store, regional hospitals, and several rural health posts to assess:
    - Existing medical cold chains at different scales
    - Refrigerant types, approximate charge, and servicing practices
    - Equipment condition and insulation quality
    - Collection of operational and energy data: electricity use (bills, estimates)
    - Cooling demand profiles and usage patterns
    - Identification of key inefficiencies, losses, and constraints
- “Last-mile: map and analyse the current transport routes and methods for vaccine distribution
- Energy infrastructure audit at the potential pilot sites.

Activity 3: Stakeholder Engagement and Needs Assessment

Objective: Understand the precise operational needs of the medical cold chain and identify implementation barriers.

Activities:

- Interviews with national and regional health officials, pharmacy managers, vaccinators, and logistics personnel to identify critical bottlenecks and user requirements
- Identification of equipment specifications (capacity, temperature) and key barriers (cost, energy access, technical capacity)
- Assessment of training and servicing gaps.

Activity 4: Technical Options Analysis and Preliminary System Design

Objective: Define feasible energy-efficient, low-GWP refrigerant solutions for medical cold chains.

Activities:

- Evaluate WHO PQS-prequalified equipment (cold rooms, freezers, and cold boxes) using natural refrigerants
- Preliminary sizing and configuration of systems for selected use cases
- Order-of-magnitude CAPEX estimates with cost-benefit analysis.

Activity 5: Project Formulation, M&V Framework, and Finalization

Objective: Develop a pilot demonstration proposal aligned with Decision 91/65.

Activities:

- Definition of project components, outputs, and expected impacts, including stationary storage and last-mile transport.
- Quantification of:
    - Energy savings (kWh/year)
    - Emission reductions (direct and indirect)
- Development of monitoring, verification, and reporting (M&V) framework focused on temperature integrity
- Preparation of implementation plan, training approach, and replication strategy
- Preparation of a detailed budget including all equipment, installation, training, and logistics; identify co-financing opportunities
- Presentation of the draft project concept to the Ministry of Public Health and technical partners to validate the proposal, incorporate their feedback and finalize the document for submission to the Multilateral Fund Secretariat.

Budget and timeline

A detailed budget is outlined in the table below. This PRP project is estimated to be implemented in 12 months. The follow-on EE project is estimated to be implemented in 24 months with an estimated budget of 400,000 USD. The full proposal is expected to demonstrate:

- Two local health facility retrofit to energy-efficient, low-GWP medical cold chains
- Two Distribution center equipped with advanced "last mile" delivery and management of vaccines (25 cold-boxes)
- Digital monitoring systems
- Solar power integration for the local health facility
- Management, training and awareness

66. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (USD)	Bilateral/ Implementing Agency
Inception, Coordination & Desk Review: Conduct a kick-off meeting with NOU and relevant stakeholder, perform relevant desk research on local and regional policies and initiatives, compile data on medical cold chains, and develop a workplan.	5,000	UNDP
Field Assessments & Baseline: Visit selected demonstration sites (~4) to collect relevant data. Work with beneficiaries to identify cooling demand profiles and usage patterns and identify key inefficiencies, losses, and constraints.	12,500	UNDP
Stakeholder Engagement: Consultations with national and regional health officials, pharmacy managers, vaccinators, and logistics personnel to identify critical bottlenecks and user requirements. equipment specifications (capacity, temperature) and key barriers (cost, energy access, technical capacity). Assess training and servicing gaps.	3,000	UNDP
Technical Analysis & Preliminary Design: Evaluate WHO PQS-prequalified equipment using non-fluorinated refrigerants, perform preliminary sizing and configuration of systems for selected use cases, and request quotes for equipment to estimate costs and perform cost-benefit analysis.	4,000	UNDP
Project Formulation & Finalization: Define project components, outputs, and expected impacts, including stationary storage and last-mile transport. Quantify energy savings and emission reductions. Develop M&V framework focused on temperature integrity. Prepare implementation plan, training approach, and replication strategy. Prepare detailed budget including all equipment, installation, training, and logistics and identify co-financing opportunities.	5,500	UNDP

Present the draft project concept to the Ministry of Public Health and technical partners to validate the proposal, incorporate their feedback and finalize the document for submission to the Multilateral Fund Secretariat.		
TOTAL	**30,000**	**-**

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Demonstration of low and ultra-low GWP based energy efficient cooling technologies in commercial refrigeration applications in India
Country:	India
Lead implementing agency:	UNDP
Implementation period for stage I of the KIP:	2029-2032
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months	
Funding requested:	

Agency	Sector	Funding requested (US $) *
UNDP	(select)	50,000

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

K. Information required for PRP funding request for the overarching strategy of the KIP

12. Montreal Protocol compliance target to be met in ☒ stage I of the KIP

Phase-out commitment (%)	**10%**	**Year of commitment**	**2032**
☐ **Servicing only**		☐ **Manufacturing only**	☐ **Servicing and manufacturing**

13. Brief background/description/information on approved relevant projects and multi-year agreements as follows:

- The current progress in implementation of any funded HFC-related project (enabling activities or stand-alone HFC investment projects)
- The current progress in ongoing HCFC phase-out management plan (HPMPs)
- Consideration of integrating HFC phase-down activities with HPMP activities taking into account previously approved HFC-related projects, if this information is available.

India ratified the Kigali Amendment to the Montreal Protocol on 27 September 2021. The Kigali Amendment came into force for India on 26 December 2021. As per the provisions of the Montreal Protocol, licensing system has been put in place before 26 March 2022. Data reporting on HFCs and blends containing HFCs is being done starting the year 2021

Regarding HCFC phase out, India has met the 2013, 2015, 2020 and 2025 compliance targets as per the accelerated phase out schedule of the Montreal Protocol through implementation of HPMP Stage-1, HPMP Stage-2 and HPMP Stage-3, as well as through the policy and regulatory framework put in place for HCFC phase out. India also complied with the provisions of agreement with the ExCom both HPMPs The Stage-3 of the HPMP approved in the 91st meeting of the ExCom of the MLF is under implementation, under which 2025 compliance targets for HCFCs have been achieved. Also, phase out of HCFCs in new manufacturing has been achieved as on 1.1.2025 Activities in the servicing sector will continue till 2030.

India does not have a full KIP under implementation, however, two (2) standalone HFC phase=down projects had been approved projects under ExCOM Decision 87/50 – one in commercial refrigeration sector and second in commercial Airconditioning sector have been implemented, for which project completion reports are under finalisation. In addition, one (1) project titled "Design and development of a pilot scale energy efficient rotary compressor along with microchannel heat exchanger compatible to R-290 technology at Godrej & Boyce Mfg. Co.

Ltd., for use in manufacturing of room air-conditioners" has been implemented under ExCOM Decision 91/65, for which project completion report is under finalisation

Once the KIP-I preparation activities start in India, the above aspects would be considered during development of overarching strategy for Stage-I of the KIP and also for any potential integration feasible between the HPMP-III and the KIP-I.

14. Overview of current HFC consumption in metric tonnes by substance (last three years)

Substance/blend	Sector	2022	2023	2024 **

Given the large quantity of HFCs consumed by India, data on HFCs for the years 2022, 2023 and 2024 is enclosed at **Annexure – II**

** Data for 2025 is under compilation

15. Based on the consumption data given above, please provide a description of the sector/sub-sector that use HFCs in the country, including a short analysis and explanation of the consumption trends (i.e., increasing or decreasing)

The sectoral analysis indicates that HFC consumption is predominantly driven by the refrigeration and air-conditioning manufacturing and servicing sectors**,** which account for the use of a wide range of gases including HFC-32, HFC-134a, HFC-125, and blends such as R-404A, R-407C, R-410A, and others. In addition to these core sectors, foam manufacturing also represents a significant area of application, utilizing gases like HFC-245fa, HFC-152a, and HFC-365MFC/227EA blends. The pharmaceutical sector has a specialized but important role, particularly through the use of HFC-134a and HFC-227ea in metered dose inhalers (MDIs).

Other niche applications include aerosols, solvents, firefighting, glass blowing, and chillers, along with emerging uses in research and development for new refrigerant blends such as R-454B**.** Overall, the data highlights that while cooling-related sectors dominate HFC usage, a diverse range of industrial and specialized applications contribute to the overall sectoral distribution.

HFC consumption shows a clear and accelerating upward trend over the period 2022–2024, increasing from 43,688 MT in 2022 to 48,772 MT in 2023 and further to 60,281 MT in 2024**,** reflecting an overall rise of about 38%**.** The growth is particularly sharp in 2024. The consumption pattern remains highly concentrated, with HFC-32, HFC-134a, HFC-125, and R-410A accounting for the bulk of usage. Among these, HFC-32 exhibits the most significant increase**,** while HFC-125 shows a notable surge in 2024**,** and HFC-134a remains consistently high across all years. Blended refrigerants and newer HFC variants show gradual but comparatively lower contributions. Overall, the data indicates a steady expansion in both the volume and composition of HFC consumption during the period under review.

16. Description of information that needs to be gathered during project preparation. Explain how this data will be gathered

Information needed	Description	Agency
Others, specify.	An overview of the concerned sector/sub-sector for each of the targeted companies against overall estimated on relevant for sector demand	UNDP
Analysis of the types of equipment using HFCs	Baseline equipment currently used, and the modifications needed	UNDP
Others, specify.	(i) Existing supply chain analysis of super-efficient/alternatives based cooling equipment, including safety aspects to be addressed on installation site (ii)Viability for the proposed alternative considering global experiences as well as national circumstances (iii) capacity of the enterprise to adopt the proposed alternative technology (iv) Quantifiable outcomes and impacts	UNDP

	particularly for enhancement of energy efficiency	

17. Activities to be undertaken for project preparation and funding (decision 87/xx(b))

Activity	Indicative funding (US $)	Agency
Data collection the development of the project proposal	5,000	UNDP
Consultation with stakeholders including national and international experts	5,000	UNDP
Assessment of quantifiable outcomes/impacts, including for enhancement of energy efficiency and reduction of direct and indirect CO2 emissions	25,000	UNDP
Analysis of the information collected and development draft project proposal	10,000	UNDP
Consultation with nodal line ministries/departments, related stakeholders and finalisation of the project proposal, translation, peer review, etc.	5,000	UNDP
TOTAL	**50,000**	

18. How will activities relate to preparing the KIP be linked to the current stages of the HPMP being implemented in the country? (OPTIONAL)

India has already phased out use of HCFCs in new manufacturing base as on 1.1.2025

19. How will the Multilateral Fund gender policy be considered during project preparation?

In line with the decision 84/92, the operational policy on gender mainstreaming would be applied wherever feasible in the preparation of the proposed projects including in the following activities (a) Encouraging participation in the consultative meetings. (b) Promoting awareness to develop staff competency and awareness on gender mainstreaming as part of the consultation exercise. (c) Share experiences and lessons learned on gender mainstreaming.

Annexure – 1

Outline of EE Pilot Project Concept Idea under Decision 91/65

PROJECT 1: Demonstrating the application of super-efficient trans-critical CO_2 and Subcritical CO_2–NH_3 Cascade Cooling Systems for Refrigerated Food Supply Chain Applications

Voltas is the oldest and largest AC equipment manufacturer in the country. Founded in 1954, the enterprise manufactures a broad range of refrigeration and AC equipment.

The proposed project aims to demonstrate and validate (field deployment at selected end-user) of CO_2-based refrigeration systems, including trans-critical CO_2 and sub-critical CO_2–NH_3 cascade systems under Indian operating conditions, as replacements for R-404A and R-410A based chiller systems to accelerate their adoption across the cold-chain sector, seeking to assess reduction in electricity consumption and demonstrate energy efficiency technologies that are, yet, not mainstreamed in India to serve as a model for large scale adoption of CO_2 based systems in food retail and cold chain sectors..

The project would:

- Assess the technical conditions for procuring and installing large commercial cooling systems with the intended technologies at up to 2 (two) end-users (one trans critical CO2 + one CO2/NH3 cascade system)
- Assess CAPEX/OPEX of for these installations at selected clients and Demonstrate the technical feasibility (installation, operation and maintenance) of CO_2 systems in large supermarkets, cold storage and cold chain logistics facilities and industrial food processing and packaging units.
- Conduct a detailed comparative analysis of emission reduction and energy efficiency enhancement would be presented compared to the existing R-410A /R-404A systems.
- Assess the safety measures relevant with Indian and International safety standards for CO_2 and NH_3 systems.

In terms of Energy Efficiency linkages, Energy efficiency gains will be estimated and validated using the following methodologies:

- Measuring the actual power consumption (in kWh) of the existing baseline refrigeration systems (typically running on high-GWP refrigerants like R-404A under various operating conditions
- Utilizing dynamic thermal building and refrigeration cycle simulations (e.g., using local weather data and ambient temperature profiles) to model the expected Coefficient of
- Integrating IoT-enabled digital sensors, pressure/temperature transmitters, and performance analysers. These systems continuously track operational parameters, calculate real-time thermodynamic performance, identify refrigerant leaks, and directly compare energy inputs against cooling outputs
- In systems involving trans-critical CO2 loops, high-grade heat can be reclaimed from the gas cooler. The energy gains can be calculated by estimating the displacement of fossil-fuel-fired boilers or electrical water heaters normally used for process heating.

In terms of linkages to the Kigali Amendment implementation in India: This project is intertwined with the Refrigeration and Air-Conditioning (RAC) servicing sector and serves as a critical strategic enabler for India's Kigali Implementation Plan (KIP), since trans-critical CO2 and Subcritical CO_2–NH_3 cascade systems operate under entirely different thermodynamic principles, pressures, and safety profiles compared to traditional HFC systems, introducing this technology mandates a complete upgrade of the service sector's capabilities. Consequently, this pilot project acts as a live demonstration and training hub that de-risks the adoption of natural refrigerants, thereby directly supporting the KIP's goal of leapfrogging high-GWP HFCs.

The project is expected to generate the following:

- Data on actual energy usage, Coefficient of Performance (COP), and the efficiency of simultaneous heating/cooling e.g., in dairy processing
- Produce detailed Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) analyses, capturing the true lifecycle cost of natural refrigerant systems versus traditional high-GWP HFC systems.
- Quantify the aggregate reductions in both direct emissions (by eliminating high-GWP refrigerants) and indirect emissions (via reduced electricity consumption).
- Assist the Bureau of Energy Efficiency (BEE) in understanding the conditions with factual data fur future potential Minimum Energy Performance Standards (MEPS) and labelling programs for the application.
- Assist Bureau of Indian Standards (BIS) in drafting updated, pragmatic safety codes for natural refrigerants in food retail and processing.
- Voltas expects that the expected the energy efficiency gains would be in the 15% to 20% range, leading to a significant reduction in indirect CO_2 emissions associated with power generation alongside the direct elimination of high-GWP refrigerants.

PROJECT 2: R1234ze and R1233zd Refrigerant Integration and Energy Efficiency Enhancement in Chillers

Blue Star Limited is India's leading Air Conditioning, Commercial Refrigeration and company with over 80 years of experience. The project proposes to demonstrate the feasibility of use o R-1234ze in chillers in replacing HFC-134a (as baseline) with enhanced energy efficiency/performance.

The demonstration will be in three selected end-users. The aim is to provide both air-cooled and water-cooled applications, incorporating both screw and centrifugal technologies to end-users:

Site 1: 1000TR R1233zd water cooled oil Free Centrifugal Chiller with permanent magnet motor and flash tank economizer
Site-2: 400TR R1234ze air cooled twin compressor Screw Chiller with permanent magnet motor and flash tank economizer
Site-3: 500TR R1234ze water cooled twin compressor Screw Chiller with permanent magnet motor and flash tank economizer

Energy efficiency gains are estimated and validated using the following methodologies:

- The theoretical and operational efficiencies such as the Coefficient of Performance (COP), Energy Efficiency Ratio (EER) of the new R1234ze and R1233zd-based chiller designs are compared against the baseline models operating on legacy refrigerants (like R-134a).
- The expected annual electricity consumption (in kWh or MWh) is calculated based on the equipment's cooling capacity and average annual operating hours. The difference between the baseline consumption and the new R1234ze and R1233zd system yields the direct energy savings.

The introduction of R1234ze (GWP<1)—an ultra-low GWP compared to R134a (GWP: 1430), mildly flammable (A2L) refrigerant— requires modernization of the service ecosystem, including technician upskilling, safety awareness, revised servicing protocols, and adoption of best practices for handling mildly flammable refrigerants. While R1233zd (GWP<5) is ultra-low GWP, non-flammable (A1) refrigerant adoption requires modernization of design, installation, servicing, and maintenance practices to ensure optimal system performance and long-term reliability.

- The project directly supports the service sector by enabling the development and deployment of low-GWP cooling solutions for commercial buildings, hotels, hospitals, data centres, educational institutions, it parks, airports, and other infrastructure facilities that rely heavily on chilled water air-conditioning systems. As these sectors increasingly seek sustainable and energy-efficient cooling technologies, R1234ze and R1233zd chillers provide a viable alternative to conventional HFC-based systems.
- The project also aligns with India's HFCs phase-down plan under the Kigali amendment to the Montreal protocol. Currently, many chillers use R134a (GWP ≈ 1430), which contributes significantly to greenhouse gas emissions. R1234ze and R1233zd offers a long-term, future-ready refrigerant solution with significantly lower environmental impact.
- By transitioning from R134a to R1234ze and R1233zd, the project helps reduce direct refrigerant emissions, supports compliance with future refrigerant regulations, and facilitates the adoption of next-generation sustainable cooling technologies in the service sector.

The project will be a catalytic initiative. While implemented at the enterprise level, the project will generate significant aggregate benefits and multiplier effects across the broader Refrigeration and Air-Conditioning (RAC) and commercial cooling sector.

- The project will generate empirical data on the performance, efficiency, and reliability of R1234ze (an A2L, mildly flammable refrigerant) and R1233zd (an A1, non-flammable refrigerant) in large-capacity chillers operating under local/high-ambient temperature conditions.
- The technical learnings, system design optimizations, and safety protocols developed during the conversion will be shared with the broader industry. This reduces the R&D burden and technical barriers for other domestic manufacturers looking to transition.
- By creating a substantial, predictable demand for R1234ze and R1233zd -compatible components (such as specialized compressors, optimized heat exchangers, electrical components, and A2L safety sensors), the project signals the market to localize and scale up the supply chain.
- The project will generate comprehensive Standard Operating Procedures (SOPs), safety guidelines, and maintenance manuals specific to A2L, mildly flammable refrigerants. These documents will serve as a foundational template that can be adopted by the broader servicing sector, integrated into the curricula of training institutes (such as ITIs).
- Data generated by this project will be instrumental in formulating, updating, and harmonizing national standards for the safe use of A2L, mildly flammable refrigerants, directly supporting the regulatory targets of the India Cooling Action Plan (ICAP) and the Kigali Amendment to the Montreal Protocol.

Blue Star Limited expects the piloted end-users to achieve high-tier energy efficiency levels in their installations, that significantly surpass current baseline market averages. The project aims take advantage of the thermodynamic advantages of the R1234ze and R1233zd refrigerant combined with advanced system design to deliver superior performance. Compared to legacy chillers

operating on baseline refrigerants (such as R-134a), the optimized R1234ze and R1233zd chillers are expected to deliver from 5% to 10% improvement in overall energy efficiency.

PROJECT 3: Transitioning to natural refrigerant CO_2 system in heat pump segment and demonstrate enhancement in energy efficiency.

Kirloskar Chillers has been a leading player in the HVAC&R space for the last 20 years.

The proposed project aims to demonstrate the feasibility, efficiency, and scalability of CO_2-based systems for heat pump segment in the Indian market through adoption of CO_2 technology and Improvement in energy efficiency and system performance.

Energy efficiency gains are estimated and will be validated using the following methodologies:

- Energy efficiency gains are first estimated theoretically by establishing a baseline. The baseline performance is defined using an equivalent-capacity heat pump or a conventional separate heating and cooling system operating on a standard high-GWP refrigerant currently prevalent in the Indian market (e.g., HFC-134a,).
- The energy efficiency of the proposed CO_2 (R-744) system is estimated using advanced thermodynamic modelling and system simulation software.
- From estimation to actual demonstration, the project incorporates rigorous performance testing plan at Kirloskar Chillers AHRI-certified test bed facility and at the demonstration site.
- The estimated energy savings will be translated into indirect greenhouse gas (GHG) emission reductions.

Transition to CO_2 (R-744) represents a significant technological shift for the Indian RAC sector. Since CO_2 operates at much higher pressures (transcritical cycle) and has distinct thermodynamic properties compared to conventional HFCs, it requires specialized handling, maintenance, and safety protocols. Hence, this project has the potential for a catalytic initiative that directly strengthens the domestic RAC servicing sector and strategically underpins India's HFC phase-down commitments under the Kigali Amendment to the Montreal Protocol.

The potential outputs will be explicitly designed to extend and provide benefit for the Heating, Ventilation, Air Conditioning, and Refrigeration (HVAC&R) sector in India and other Article 5 countries, as follows:

- The project will generate a comprehensive, empirically validated dataset on the performance, energy efficiency, and operational reliability of CO_2 heat pumps in Indian ambient conditions. This data will provide the sector with a clear, real-world Cost-Benefit Analysis, proving the commercial and technical viability of the technology to end-users and other manufacturers.
- The project will host technology dissemination workshops targeting industry stakeholders, consultants, and policymakers. By openly sharing the design challenges, solutions, and operational data, the project significantly reduces the R&D learning curve for other enterprises looking to adopt natural refrigerants, fostering faster sector-wide replication.
- The project will generate comprehensive Standard Operating Procedures (SOPs), safety guidelines, and maintenance manuals specific to high-pressure natural refrigerants. These documents will serve as a foundational template that can be adopted by the broader servicing sector, integrated into the curricula of training institutes (such as ITIs).
- Data generated by this project will be instrumental in formulating, updating, and harmonizing national standards for the safe use of high-pressure natural refrigerants, directly supporting the regulatory targets of the India Cooling Action Plan (ICAP) and the Kigali Amendment to the Montreal Protocol.

While exact percentage gains depend on the final field-validated data, Kirloskar expects to demonstrate high levels of energy efficiency through the following performance metrics and technological mechanisms:

- The most significant level of efficiency expected from this project comes from the application of the heat pump for simultaneous cooling and heating, which captures the rejected heat from the cooling cycle to generate hot water (up to 90°C). This expects to deliver a remarkably high Total Efficiency Ratio (TER) or Combined COP, drastically reducing the combined electrical and fossil fuel footprint compared to the baseline separate systems.
- From a holistic energy efficiency standpoint, the expected level of performance will be measured via Life Cycle Climate Performance (LCCP). Because CO_2 has a Global Warming Potential (GWP) of 1, the direct emissions are negligible. By demonstrating electrical energy savings (reducing indirect emissions) and eliminating fossil-fuel use for heating, the project expects to showcase an exceptionally low total carbon footprint over the equipment's lifespan.

The target industry for this demonstration will be a commercial or industrial facility that has a continuous, high demand for simultaneous heating and cooling and include industries such as dairy processing, food and beverage manufacturing, pharmaceuticals, large hotels, or hospitals. The enterprise will replace the existing conventional heat pump or chiller/boiler setup with a newly designed CO_2 system. CO_2 system requires specially engineered, high-pressure-rated components including electronic

expansion valves, high-pressure CO_2 compressors, and often efficiency-enhancing modifications like ejectors or parallel compression systems. Also, modifying an old system to handle CO_2 would pose severe safety risks.

Annexure – II

HFC 2022 Data

HFCs		Production	Import	Export	Consumption
HFC-32	Mt	9590.20	8994.68	2391.383	16193.497
	mt CO_2-eq	6473385	6071409	1614183.525	10930610.48
HFC-125	Mt	8754.751	122.26	4874.95	4002.061
	mt CO_2-eq	30641628.5	427910	17062325	14007213.5
HFC-134a	Mt	14727.82	9125.191	6112.542	17740.469
	mt CO_2-eq	21060782.6	13049023.13	8740935.06	25368870.67
HFC-152a	Mt		2940.478	4.970	2935.508
	mt CO_2-eq		364619.272	616.28	364002.992
HFC-227ea	Mt		263.973	0.415	263.558
	mt CO_2-eq		849993.06	1336.3	848656.76
HFC-236fa	Mt		72.584	0.155	72.429
	mt CO_2-eq		712049.04	1520.55	710528.49
HFC-245fa	Mt		1064.839	0	1064.839
	mt CO_2-eq		1096784.17	0	1096784.17
HFC-365MFC	Mt		38.4	0	38.4
	mt CO_2-eq		30489.6	0	30489.6
HFC-43-10mee	Mt		0.6	0	0.6
	mt CO_2-eq		984		984
HFC-23	Mt		0	0	0
	mt CO_2-eq		0	0	0
R-404A	Mt		1265.6	227.334	1038.266
	mt CO_2-eq		4963683.2	891603.948	4072079.252
R-407C	Mt		718.92	274.371	812.049**
	mt CO_2-eq		1275364.08	486734.154	1440574.926
R-407F	Mt		1.452		1.452
	mt CO_2-eq		2649.9		2649.9
R-410A	Mt		3887.67	4627.717	3814.326**
	mt CO_2-eq		8117454.96	9662673.096	7964312.688
R-426A	Mt		20	0	20
	mt CO_2-eq		30160		30160
R-438A	Mt		200	0	200
	mt CO_2-eq		452800		452800
R-467A	Mt		0	37.800	0
	mt CO_2-eq			51370.2	
R-454B	Mt		0.176	0	0.176
	mt CO_2-eq		81.84	0	81.84
R-454C	Mt		0.073	0	0.073
	mt CO_2-eq		10.585	0	10.585
R-455A	Mt		0.8	0	0.8
	mt CO_2-eq		116	0	116
R-513A	Mt		0.684	0	0.684
	mt CO_2-eq		430.236	0	430.236
HFC-365mfc/HFC-227ea	Mt		115.2	0	115.2
	mt CO_2-eq		132480	0	132480

**As per Article-7 and Country Programme Progress Report, no need to report the production of mixtures/blends. However, the consumption is calculated considering R-407C production= 367.5 MT and R-410A production= 4554.373 during the year 2022.

HFC 2023 Data

HFC		Production (MT)	Export (MT)	Import (MT)	Consumption (MT)
HFC-32	**MT**	11459.11	2856.496	8844.9	17447.514
	mt CO2-eq	7734899.25	1928134.8	5970307.5	11777071.95
HFC-41	**MT**	0	0	0.000025	0.000025
	mt CO2-eq	0	0	0.0023	0.0023
HFC-125	**MT**	10282.102	7126.832	373.975	3529.245
	mt CO2-eq	35987357	24943912	1308912.5	12352357.5
HFC-134a	**MT**	13476.12	5367.726	7701.665	15810.059
	mt CO2-eq	19270851.6	7675848.18	11013380.95	22608384.37
HFC-227ea	**MT**	0	5.07	308.626	303.556
	mt CO2-eq	0	16325.4	993775.72	977450.32
HFC-152a	**MT**	0	0	4502.914	4502.914
	mt CO2-eq	0	0	558361.336	558361.336
HFC-245fa	**MT**	0	0	1772.705	1772.705
	mt CO2-eq	0	0	1825886.15	1825886.15
HFC-236fa	**MT**	0	0.52	84.908	84.388
	mt CO2-eq	0	5101.2	832947.48	827846.28
HFC-365MFC	**MT**	0	0	19.8	19.8
	mt CO2-eq	0	0	15721.2	15721.2
HFC-43-10mee	**MT**	0	0	0.9	0.9
	mt CO2-eq	0	0	1476	1476
R-404A	**MT**		239.016	1294.8	1055.784
	mt CO2-eq		937420.752	5078205.6	4140784.848
R-407C	**MT**		492.533	538.776	598.943
	mt CO2-eq		858977.552	939625.344	1044556.592
R-410A	**MT**		5922.993	3492.061	2971.608
	mt CO2-eq		12367209.38	7291423.368	6204717.504
R-426A	**MT**		0	40	40
	mt CO2-eq		0	60320	60320
R-438A	**MT**		0	260	260
	mt CO2-eq		0	588640	588640
R-448A	**MT**		0	5.896	5.896
	mt CO2-eq		0	8171.856	8171.856

R-449A	**MT**		0	0.999	0.999
	mt CO2-eq		0	1394.604	1394.604
R-454B	**MT**		0	0.521	0.521
	mt CO2-eq		0	242.265	242.265
R-454C	**MT**		0	0.184	0.184
	mt CO2-eq		0	26.68	26.68
R-508B	**MT**		0	1.278	1.278
	mt CO2-eq		0	8700.624	8700.624
R-513A	**MT**		0	1.368	1.368
	mt CO2-eq		0	860.472	860.472
HFC-365mfc/HFC-227ea* (87%/13%)	**MT**		0	364.8	364.8
	mt CO2-eq		0	419520	419520

***As per Article-7, no need to report the production of mixtures/blends. However, the consumption is calculated considering R-407C production= 552.70 MT and R-410A production= 5402.540 during the year 2023.**

HFC 2024 Data

HFC		Production (MT)	Export (MT)	Import (MT)	Consumption (MT)
HFC-23	**MT**	0	0	18	18
	mt CO2-eq	0	0	266400	266400
HFC-32	**MT**	23583.22	4841.093	4678.462	23420.589
	mt CO2-eq	15918673.5	3267737.775	3157961.85	15808897.58
HFC-125	**MT**	9177.708	2943.3	2006.231	8240.639
	mt CO2-eq	32121978	10301550	7021808.5	28842236.5
HFC-134a	**MT**	13739.15	4301.421	5901.916	15339.645
	mt CO2-eq	19646984.5	6151032.03	8439739.88	21935692.35
HFC-227ea	**MT**	0	3.083	266.983	263.9
	mt CO2-eq	0	9927.26	859685.26	849758
HFC-152a	**MT**	0	0	5186.489	5186.489
	mt CO2-eq	0	0	643124.636	643124.636
HFC-245fa	**MT**	0	0	349.5	349.5
	mt CO2-eq	0	0	359985	359985
HFC-236fa	**MT**	0	1.27	101.48	100.21
	mt CO2-eq	0	12458.7	995518.8	983060.1
HFC-43-10mee	**MT**	0	0	3.948	3.948

	mt CO2-eq	0	0	6474.72	6474.72
R-404A	**MT**		348.793	2596.906	2248.113
	mt CO2-eq		1367966.146	10185065.33	8817099.186
R-407C	**MT**		384.448	82.56	505.852
	mt CO2-eq		670477.312	143984.64	882205.888
R-410A	**MT**		6959.709	1089.02	4291.109
	mt CO2-eq		14531872.39	2273873.76	8959835.592
R-438A	**MT**		0	120	279.7
	mt CO2-eq		0	271680	633240.8
R-449A	**MT**		0	7.042	7.042
	mt CO2-eq		0	9830.632	9830.632
R-449C	**MT**		0	1.298	1.298
	mt CO2-eq		0	1622.5	1622.5
R-454B	**MT**		0	8.596	8.596
	mt CO2-eq		0	3997.14	3997.14
R-507A	**MT**		0	14.49	14.49
	mt CO2-eq		0	57742.65	57742.65
R-508B	**MT**		0	0.84	0.84
	mt CO2-eq		0	5718.72	5718.72
R-513A	**MT**		0	0.938	0.938
	mt CO2-eq		0	590.002	590.002
HFC-365mfc/HFC-227ea	**MT**		38.4	0	0
	mt CO2-eq		44160	0	0

***As per Article-7 and Country Programme Progress Report, no need to report the production of mixtures/blends. However, the consumption is calculated considering R-407C production= 807.740 MT, R-410A production= 10161.798 and R-438A production=159.70 MT during the year 2024.**

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Preparatory Activities for a Pilot Project on Energy Efficient, Low GWP Refrigeration Systems in Kenya's Fisheries Processing and Cold Chain Infrastructure	
Country:	Kenya	
Lead implementing agency:	UNDP	
Implementation period for the energy efficiency project:	36 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Servicing	30,000 USD

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

L. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

67. Agency:	UNDP
68. Sector:	Refrigeration
69. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2024 ☐ **No**
70. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter _____ ☐ **No** ☒ **N/A**
71. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No** ☒ **N/A**
72. Please explain briefly how the investment project would relate to the overarching	The first stage of KIP for Kenya will be submitted in a later ExCom meeting. This project will contribute to

strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	conduct the technology substitution in the commercial refrigeration sector, particularly in the cold rooms used in different markets and installations, promoting in advance the reduction mainly of R-404A to support the upcoming KIP I project.

73. Project Description

Background information

The fisheries sector is a vital component of Kenya's economy, supporting the livelihoods of 1.5 million people directly and indirectly, and playing a critical role in national food security. The sector is formally recognized as a key pillar in Kenya's ambitious "Blue Economy" strategy, which seeks to sustainably harness the potential of the country's aquatic resources.

Kenya's fish production is primarily derived from three sources:

1. Inland Capture Fisheries (Lake Victoria): This is the dominant source, accounting for over 70% of the national catch. It supports a massive artisanal fishing fleet and a highly industrialized export sector focused on Nile Perch (Lates niloticus), alongside vital domestic catches of Tilapia and Omena (Silver Cyprinid).
2. Marine Capture Fisheries: Despite a long coastline on the Indian Ocean, marine fisheries contribute less to the total volume but are critical for coastal communities. The sector is largely artisanal, operating near the shore.
3. Aquaculture: A rapidly growing sector, heavily promoted by the government to bridge the widening gap between domestic fish demand and stagnating wild catches.

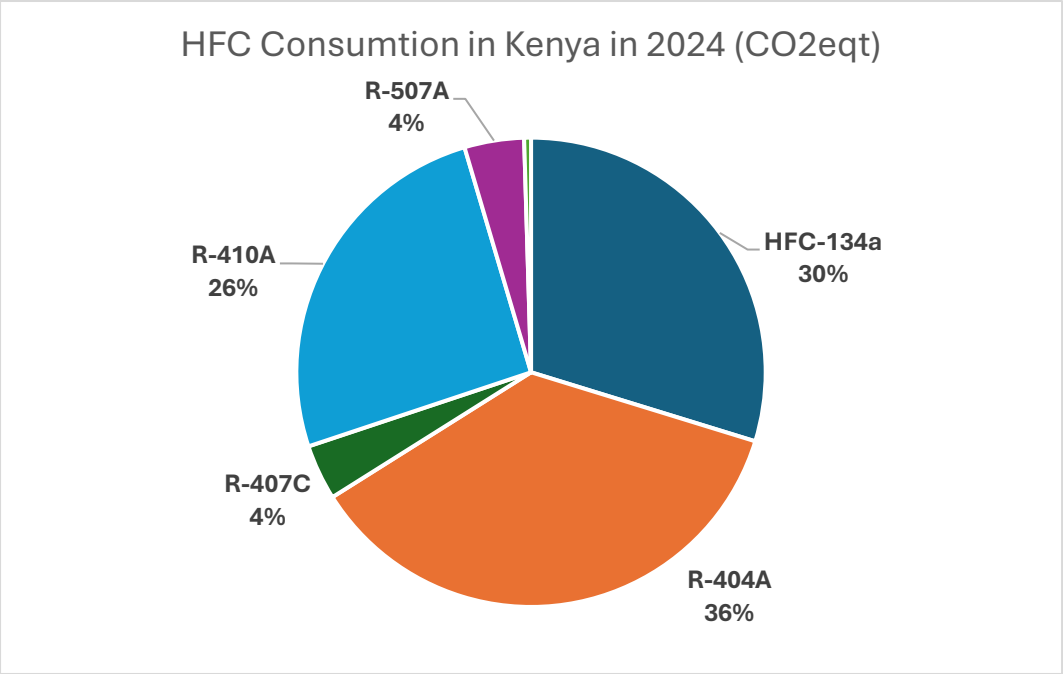
A continuous and robust cold chain, from the point of catch to processing, and finally to the consumer or export market, is the absolute prerequisite for the economic viability of this sector. Fish is highly perishable, and in Kenya's tropical climate, spoilage occurs rapidly without immediate chilling.

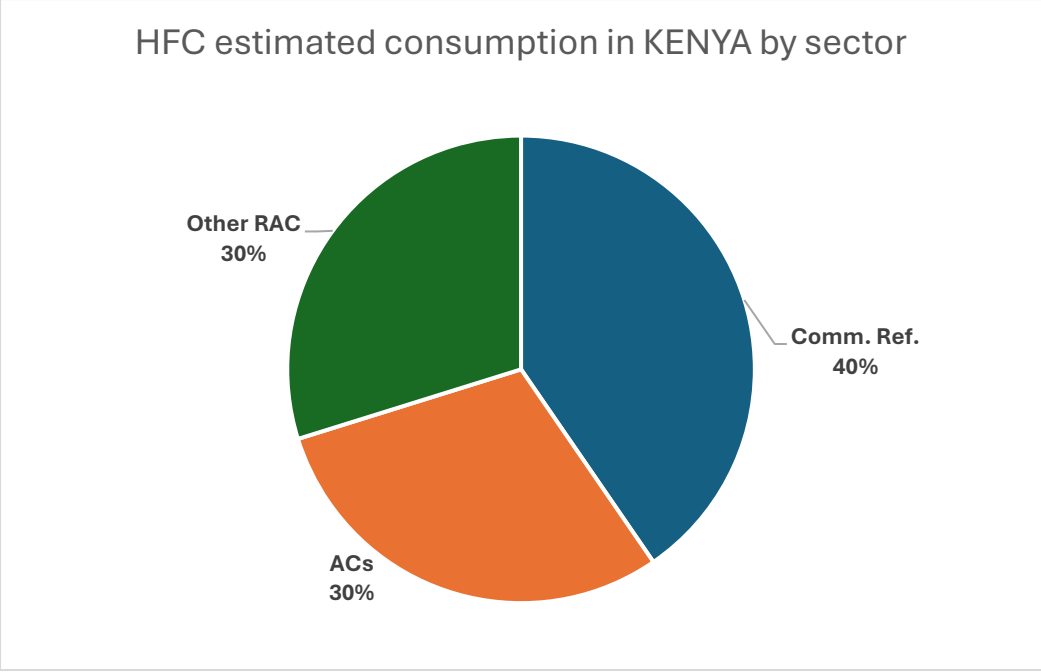
Currently, the refrigeration infrastructure supporting this sector is characterized by:

- Ice Production: Flake and block ice machines are essential at landing sites (e.g., Kisumu, Homa Bay, Mombasa) to chill the catch on boats and during initial transport.
- Cold Storage: Walk-in cold rooms are used by fisher cooperatives and traders to aggregate the catch before sale to processors or urban markets.
- Industrial Freezing: The Nile Perch export industry relies on large, energy-intensive blast freezers and massive cold storage facilities (-20°C to -25°C) to process and store fillets for the European and global markets.

The vast majority of these existing refrigeration systems utilize high-GWP refrigerants, predominantly R-404A and R-507A, and in some older installations, HCFC-22. Furthermore, these systems are often aging, poorly maintained, and utilize obsolete, energy-inefficient compressor technologies.

The HFC consumption in 2024 in Kenya is 238.21 MT, of which 47.37 MT were of R-404A and 5.27 of R-507A, the main refrigerants used in cold storage chambers in the commercial refrigeration subsector. In terms of climate impact, the total consumption of HFC is 511,565 CO2eqt, of which 206,767 CO2eqt are R-404A and R-507. As a result, both refrigerants contribute to 40.4% of the total HFC consumption by CO2eqt.





Refrigerant & Energy Impact: The sector relies heavily on aging, energy-intensive refrigeration systems (ice makers, cold rooms, freezers, and processing plants) that predominantly use high-GWP refrigerants like R-404A and HCFC-22.

Energy Insecurity: In key production zones like the Lake Victoria basin, unreliable grid electricity forces operators to depend on expensive and polluting diesel generators, making the cost of ice and cold storage prohibitively high.

Systemic Challenges:

- Insufficient ice production capacity at major landing sites.
- Reliance on outdated, poorly insulated cold rooms with high energy consumption.
- Lack of access to affordable and reliable cooling for small-scale fish traders, who are predominantly women.

As Kenya advances its commitments under the Kigali Amendment and supports its national Blue Economy strategy, modernizing the fisheries cold chain represents a strategic opportunity. This PRP will address the critical data gaps that currently prevent the design of a full-scale project, including:

- No comprehensive inventory of RAC equipment at landing sites and processing plants.
- Unknown energy consumption baselines for ice machines and cold rooms.
- Limited data on ice demand and distribution patterns.
- No gender-responsive analysis of the needs of women in the post-harvest value chain.

Challenges and Opportunities

The Kenyan fisheries value chain is severely hampered by a fragmented and inefficient cold chain, leading to estimated post-harvest losses of up to 19%. This represents a massive economic drain and a threat to food security. The sector faces several systemic challenges directly related to refrigeration and energy:

- Inadequate Ice Supply at the "First Mile": Many vital landing sites along Lake Victoria and the coast lack sufficient ice production capacity. Artisanal fishers often go to sea without ice, leading to immediate quality degradation upon catch.
- High Energy Costs and Grid Instability: The electrical grid in many rural fishing communities and landing sites is unreliable, suffering from frequent power outages and voltage fluctuations. To maintain the cold chain, operators (from small cooperatives to large industrial processors) are forced to rely heavily on expensive, highly polluting diesel generators. The high cost of electricity and diesel makes ice and cold storage prohibitively expensive for many small-scale operators.

- Inefficient and High-GWP Technology: Existing cold rooms and ice machines are largely inefficient. They suffer from poor thermal insulation, lack modern electronic capacity controls (like Variable Frequency Drives), and operate continuously even during low-load periods. The continued reliance on R-404A not only contributes to high direct emissions through leakage but also performs sub-optimally in high ambient temperatures, further increasing energy consumption.
- Gender Disparities in the Value Chain: The post-harvest sector, particularly the artisanal processing and trading of fish (like Omena), is dominated by women (often referred to locally as "Mama Karanga"). However, these women frequently lack access to affordable cold storage, forcing them to rely on traditional, less profitable preservation methods (sun-drying/smoking) or to sell their fresh catch immediately at depressed prices to avoid spoilage.

Modernizing the cold chain infrastructure is essential to reduce HFC consumption, improve energy efficiency, and enhance food safety. Introducing natural refrigerant technologies (NH_3, CO_2, HC-290) and integrating renewable energy (solar PV) will support Kenya's climate commitments while improving operational performance.
The proposed project aligns with Kenya's obligations under the Kigali Amendment, contributes to the country's Nationally Determined Contribution (NDC), and is consistent with the objectives of the Blue Economy strategy. It also aligns with ExCom Decision 91/65.
To prepare a full project proposal, Kenya requires a detailed technical assessment to address critical data gaps, as no comprehensive inventory or energy baseline currently exists for this sector.

Project Objectives

The purpose of the preparatory project is to generate the technical, economic, and institutional baseline required to design a pilot demonstration project on energy-efficient, low-GWP fishery cold chain in Kenya, in line with Decision 91/65. Specifically, the preparatory activities will: (i) establish a robust baseline of the fishery cold chains; (ii) assess the technical feasibility of alternative low-GWP technologies; and (iii) identify key stakeholders and capacity gaps.

Expected Outcomes

The preparatory phase of the project will be led by the NOU and the State Department with technical support from UNDP . The preparatory phase will deliver a fully developed project proposal that defines the selected technologies, implementation modalities, and M&V framework. It will include a detailed inventory of the fishery cold chain, an evaluation of baseline performance, a gender-responsive assessment, and a capacity-building plan.

The PRP will further evaluate the technical, economic, and safety feasibility of deploying low-GWP, energy-efficient alternatives under local climatic conditions, infrastructure constraints, and servicing practices. This will include identification of regulatory, standards, and capacity gaps, as well as requirements for safe handling of flammable and high-pressure refrigerants.

In parallel, the preparatory phase will incorporate a gender-responsive assessment of the fishery cold chain sector to identify differentiated roles, barriers, and opportunities, and to inform inclusive capacity-building and implementation strategies.

The principal output of the PRP will be a fully developed, project proposal in line with Decision 91/65. This proposal will define the selected technologies, implementation modalities, cost structure, and monitoring and verification framework, and will articulate the expected impacts in terms of improved energy efficiency, reduced direct and indirect emissions, strengthened technical capacity, enhanced food safety, and reduced food losses, with clear potential for replication within Kenya and across similar Eastern African contexts.

Key Deliverables

In addition to the Project Document, the following key deliverables will contribute to achieving the project's overarching outcome:

- Inventory of fishery cold chain in Kenya
- Detailed evaluation for the baseline fisheries' performance of selected sites
- Gender-responsive assessment of the fishery cold chain sector to identify differentiated roles, barriers, and opportunities, and to inform inclusive capacity-building and implementation strategies.
- Capacity building and knowledge transfer: empowering stakeholders to actively contribute to the advancement of energy efficiency in the sector.

Project Activities

The preparatory phase will begin with a structured inception process led by the National Ozone Unit, and involving the Ministry of Mining, Blue Economy and Maritime Affairs, the Kenya Fisheries Service (KeFS), and other relevant institutions.

Following inception, the project will undertake a comprehensive collection of background information. This will include a review of national policies, energy tariffs, existing cold chain infrastructure, and previous donor supported initiatives. Particular attention will be given to identifying gaps in current refrigeration systems, energy efficiency practices, and cold chain management.

Field assessments will constitute the core of the PRP. Multidisciplinary teams will visit key fisheries hubs across Kenya, locations to be determined during the inception phase, to conduct detailed technical evaluations of ice plants, freezing tunnels, cold rooms, freezing rooms, and associated processing infrastructure. These assessments will document equipment age, refrigerant type, charge size, operational status, insulation quality, and energy consumption patterns. The fieldwork will also include an analysis of ice demand and distribution patterns, which are essential for sizing new equipment and optimizing processing workflows.

Stakeholder consultations will be carried out with fishers, processors, women's groups, cold chain operators, and Refrigeration technicians. These consultations will help identify operational challenges, capacity gaps, and opportunities for technology adoption. A gender responsive assessment will be integrated to ensure that the needs and constraints of women processors, who play a central role in post-harvest handling, are fully captured.

Based on the findings of the field assessments and consultations, the project will conduct a technical options analysis to evaluate the feasibility of transitioning to natural refrigerant technologies such as NH_3, CO_2, and HC-290. This analysis will consider safety requirements, energy efficiency potential, equipment availability, and long-term sustainability. The preparatory phase will also explore the potential for integrating solar PV systems to reduce operational costs and improve resilience to power outages.

The results of these assessments will inform the development of a full project concept, including detailed components, expected outcomes, cost estimates, and an emissions reduction analysis. A monitoring and verification framework will be drafted to ensure that the project's impacts can be measured effectively. The preparatory phase will conclude with a validation workshop involving national stakeholders, after which the final project document will be submitted to the Multilateral Fund Secretariat.

The activities are broken down as follows:

- Activity 1: Inception and Baseline Assessment: Project inception and stakeholder coordination; comprehensive inventory assessment of cold chains in the fisheries sector; and technical energy audits of selected demonstration sites.
- Activity 2: Field Assessments and Establishing Baseline: Visit approximately 5 selected demonstration sites in key fisheries hubs (e.g., on the coast and Lake Victoria basin) to collect data, identify cooling demand profiles, and assess key inefficiencies.
- Activity 3: Stakeholder Engagement: Consult with fisheries stakeholders, Refrigeration technicians, training institutions, and government/private-sector partners to identify cooling requirements and key barriers.
- Activity 4: Technical and Economic Feasibility Analysis: Conduct a technical options analysis for low-GWP alternatives, a gender-responsive needs assessment, and a feasibility study for renewable energy integration.
- Activity 5: Development of Full Project Proposal: Formulate the project components and budget, conduct an emissions analysis, hold a stakeholder validation workshop, and finalize the project document for submission.

Budget and timeline

A detailed budget is outlined in the table below. This PRP project is estimated to be implemented in 12 months. The follow-on EE project is estimated to be implemented in 24 months with an initial estimated budget of 800,000 USD. The full proposal is expected to demonstrate:

- One energy-efficient, low-GWP flake-ice plants (2–3 tons/day)
- One energy-efficient, low-GWP block-ice plant (3–5 tons/day)
- One energy-efficient, low-GWP Blast freezer (300-500 kg/hour),
- One cold room (30- 50 m^3)
- One freezing room (30- 50 m^3)

- Management, training and awareness

74. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (USD)	Bilateral/ Implementing Agency
Inception, Coordination & Desk Review: Under the leadership of the NOU and the State Department of Environment, conduct a kick-off meeting with relevant stakeholder, perform relevant desk research on local and regional policies and initiatives, and develop a workplan.	3,000	UNDP
Field Assessments & Baseline: Visit selected demonstration sites (~5) and fisheries cold chains to collect relevant data. Work with beneficiaries to identify cooling demand profiles and usage patterns and identify key inefficiencies, losses, and constraints.	12,000	UNDP
Stakeholder Engagement: Consultations with minimarket and supermarket operators, RAC technicians and training institutions, and women in the workforce, and government and private-sector stakeholders. Identify cooling requirements and key barriers. Assess training and servicing gaps.	3,000	UNDP
Technical Analysis & Preliminary Design: Screen energy-efficient, low-GWP technology options. Perform preliminary sizing and configuration of systems for selected use cases and obtain potential quotes for CAPEX requirements.	5,000	UNDP
Project Formulation & Finalization: Define project components, outputs, and expected impacts, quantifying energy savings and emission reductions. Develop M&V framework and prepare an implementation plan. Define the training and capacity building approaches. And devise a replication strategy. Conduct a validation workshop with stakeholders and finalise submission to the Multilateral Fund Secretariat.	7,000	UNDP
TOTAL	**30,000**	**-**

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Preparatory Activities for a Pilot Project on Energy Efficient, Low GWP Refrigeration Systems in Senegal's Fisheries Processing and Cold Chain Infrastructure	
Country:	Senegal	
Lead implementing agency:	UNDP	
Implementation period for the energy efficiency project:	36 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Servicing	30,000 USD

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

M. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

75. Agency:	UNDP
76. Sector:	Refrigeration
77. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2024 ☐ **No**
78. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter _____ ☐ **No** ☒ **N/A**
79. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No** ☒ **N/A**
80. Please explain briefly how the investment project would relate to the overarching	The first stage of KIP for Senegal was approved in the 95th ExCom meeting in December 2024, for the

strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	reduction of 10% of baseline. This project will contribute to conduct the technology substitution in the commercial refrigeration sector, particularly in the cold rooms used in different markets and installations, promoting the reduction mainly of R-404A.

81. Project Description

Background information

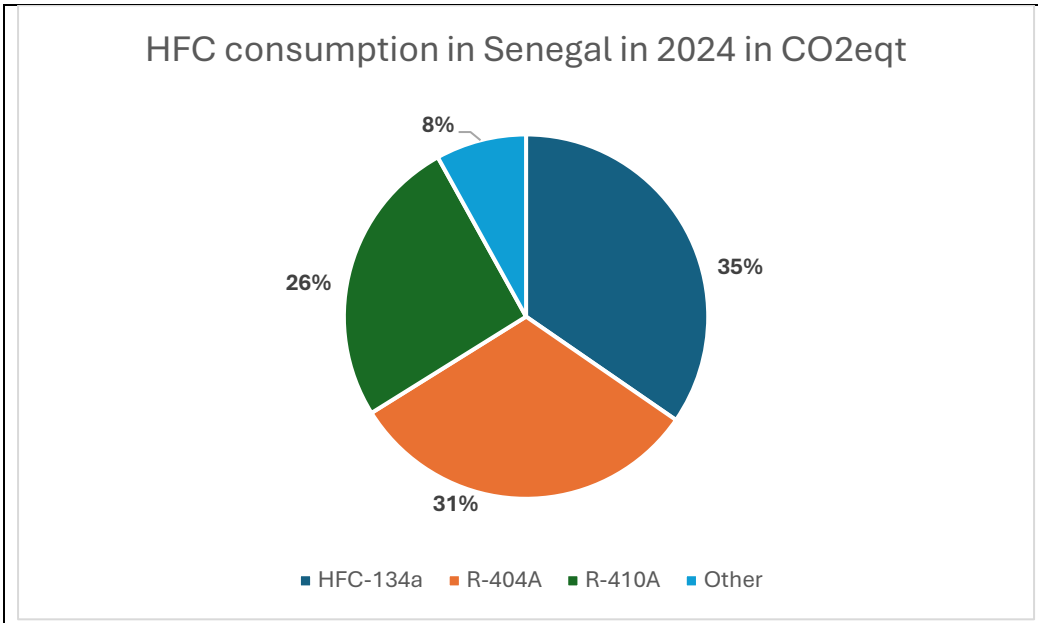
Senegal is one of the most important fisheries nations in West Africa, with a sector that plays a central role in national food security, employment, and economic stability. Fisheries contribute significantly to GDP and support hundreds of thousands of livelihoods across artisanal, semi-industrial, and industrial value chains. Fish remains a primary source of protein for the population and a critical commodity for domestic markets, particularly in coastal regions where fishing is deeply embedded in cultural and economic life.

Senegal is Party to the Montreal Protocol and the Kigali Amendment, committing to the phasedown of high GWP hydrofluorocarbons (HFCs). The fisheries sector—particularly processing facilities, ice plants, and cold chain infrastructure—relies heavily on refrigeration systems using high GWP refrigerants such as R 404A and R 507A. Many of these systems are outdated, energy intensive, and prone to leakage, resulting in high operational costs and significant climate impact.

As Senegal advances its commitments under the HPMP, its Nationally Determined Contribution (NDC), and the Plan Sénégal Émergent (PSE), the modernization of fisheries cold chain infrastructure represents a strategic opportunity to reduce HFC consumption, improve energy efficiency, and strengthen food security. This PRP request seeks to lay the groundwork for a full project that will address these challenges.

Senegal's fisheries sector supports an estimated 600,000 livelihoods, including fishers, processors, transporters, vendors, and cold chain operators. The sector is characterized by a large artisanal fleet operating along the Petite Côte, Grande Côte, and Casamance, complemented by semi-industrial and industrial vessels supplying processing hubs. Processing activities—such as filleting, gutting, drying, and freezing—are widespread, and women play a central role in post-harvest handling, processing, and marketing.

The HFC consumption in 2024 in Senegal is 1,050 MT, of which 180.58 MT of R-404A and R-507A, the main refrigerant used in fishery cold chain in the commercial refrigeration subsector. In terms of climate impact, the total consumption of HFC is 2,122,051 CO2eqt, of which 708,797 CO2eqt is attributed to R-404A and R-507A. As a result, these 2 refrigerants contribute to 33.4% of the total HFC consumption by CO2eqt.



Challenges and Opportunities

Despite its importance, the sector faces significant cold chain constraints. Ice production capacity is insufficient in many landing and processing areas, forcing artisanal fishers to travel long distances to obtain ice, which often melts before reaching the fishing grounds. Processing facilities frequently rely on outdated freezing tunnels and cold rooms that use high GWP refrigerants and consume large amounts of energy. Aging compressors, poor insulation, and limited temperature monitoring contribute to high operational costs and inconsistent product quality.

Frequent power outages further compromise the cold chain, leading to spoilage and economic losses. Post harvest losses remain high, particularly in artisanal and semi industrial value chains where access to reliable cold storage is limited.

This can be summarized as follows:

- Insufficient ice production capacity in key landing/processing areas.
- Reliance on outdated and energy-intensive freezing tunnels and cold rooms.
- Widespread use of high-GWP refrigerants like R-404A and R-507A.
- High operational costs due to aging compressors, poor insulation, and lack of temperature monitoring.
- Product spoilage and economic losses due to frequent power outages.

Modernizing the cold chain and processing infrastructure is essential to reduce HFC consumption and leakage, improve energy efficiency, and enhance food safety and product quality. Upgrading ice production systems, freezing tunnels, cold rooms, and freezing rooms will help reduce post harvest losses and strengthen the resilience of the sector to power instability. Introducing natural refrigerant technologies (NH_3, CO_2, HC 290) will support Senegal's climate commitments while improving operational performance.

The proposed project aligns with Senegal's obligations under the Kigali Amendment and supports the implementation of HPMP Senegal. It contributes to the country's NDC targets and is consistent with the objectives of the Plan Sénégal Émergent (PSE), which prioritizes modernization of productive sectors and improved energy efficiency. The project also aligns with ExCom Decision 91/65, which encourages integrated approaches to energy efficiency and low GWP transitions in the commercial refrigeration sector.

To prepare a full project proposal, Senegal requires a detailed technical assessment of its fisheries cold chain and processing infrastructure. Currently, no comprehensive inventory exists of refrigeration systems in processing hubs, nor are there energy consumption baselines for freezing tunnels and cold rooms. Data on ice demand and distribution patterns are limited, and no assessment has been conducted on the feasibility of transitioning to natural refrigerant alternatives. A gender responsive analysis is also needed to understand the specific needs of women processors and vendors.

The PRP will address these gaps by conducting field assessments, technical studies, and stakeholder consultations across multiple regions.

Project Objectives

The purpose of the preparatory project is to generate the technical, economic, and institutional baseline required to design a pilot demonstration project on energy-efficient, low-GWP fishery cold chain in Senegal, in line with Decision 91/65. Specifically, the preparatory activities will: (i) establish a robust baseline of the fishery cold chains, including equipment typologies, refrigerant use, energy performance, and servicing practices; (ii) assess the technical feasibility, safety requirements, and market readiness of alternative low-GWP, energy-efficient technologies (including HC-290, R-744 systems, and R-717) under Senegal's climatic and operational conditions; and (iii) identify key stakeholders, capacity gaps, and enabling conditions for implementation, including technician training needs and monitoring and verification (M&V) frameworks.

The preparatory project will culminate in the development of a comprehensive project proposal document for a pilot demonstration. This document will define the technology selection, system design specifications, implementation strategy, project sustainability and replicability in the fisheries cold chain sector in Senegal and sub-Saharan Africa, and expected energy and climate benefits, supported by a clear M&V methodology.

The proposed demonstration project, to be developed under this preparatory phase, is expected to validate the performance, safety, and scalability of non-fluorinated refrigeration systems in the fisheries sector, while strengthening local technical capacity, introducing digital monitoring and performance tracking tools, and establishing a replicable model for broader adoption in Senegal and, where applicable, in other sub-Saharan African countries.

Expected Outcomes

The preparatory phase will deliver an evidence-based characterization of the fisheries cold chain sector in Senegal, including an inventory of refrigeration equipment, refrigerant use, and operating conditions,

together with a quantified baseline of energy performance and associated emissions. Based on this assessment, the PRP will identify and justify suitable pilot demonstration sites.

The PRP will further evaluate the technical, economic, and safety feasibility of deploying low-GWP, energy-efficient alternatives under local climatic conditions, infrastructure constraints, and servicing practices. This will include identification of regulatory, standards, and capacity gaps, as well as requirements for safe handling of flammable and high-pressure refrigerants.

In parallel, the preparatory phase will incorporate a gender-responsive assessment of the fishery cold chain sector to identify differentiated roles, barriers, and opportunities, and to inform inclusive capacity-building and implementation strategies.

The principal output of the PRP will be a fully developed, project proposal in line with Decision 91/65. This proposal will define the selected technologies, implementation modalities, cost structure, and monitoring and verification framework, and will articulate the expected impacts in terms of improved energy efficiency, reduced direct and indirect emissions, strengthened technical capacity, enhanced food safety, and reduced food losses, with clear potential for replication within Senegal and across similar sub-Saharan African contexts.

Key Deliverables

In addition to the Project Document, the following key deliverables will contribute to achieving the project's overarching outcome:

- Inventory of fishery cold chain in Senegal
- Detailed evaluation for the baseline fisheries' performance of selected sites
- Gender-responsive assessment of the fishery cold chain sector to identify differentiated roles, barriers, and opportunities, and to inform inclusive capacity-building and implementation strategies.
- Capacity building and knowledge transfer: empowering stakeholders to actively contribute to the advancement of energy efficiency in the sector.

Project Activities

The preparatory phase will begin with a structured inception process involving the Direction des Pêches Maritimes (DPM), the Ministry of Environment, CRODT, and other relevant institutions. During this stage, roles and responsibilities will be clarified, communication channels established, and a detailed work plan developed. This will ensure that all stakeholders share a common understanding of the project's objectives and the scope of the preparatory activities.

Following inception, the project will undertake a comprehensive collection of background information. This will include a review of national policies, energy tariffs, existing cold chain infrastructure, and previous donor supported initiatives. Particular attention will be given to identifying gaps in current refrigeration systems, energy efficiency practices, and cold chain management.

Field assessments will constitute the core of the PRP. Multidisciplinary teams will visit key fisheries hubs across Senegal—locations to be determined during the inception phase—to conduct detailed technical evaluations of ice plants, freezing tunnels, cold rooms, freezing rooms, and associated processing infrastructure. These assessments will document equipment age, refrigerant type, charge size, operational status, insulation quality, and energy consumption patterns. The fieldwork will also include an analysis of ice demand and distribution patterns, which are essential for sizing new equipment and optimizing processing workflows.

Stakeholder consultations will be carried out with fishers, processors, women's groups, cold chain operators, and RAC technicians. These consultations will help identify operational challenges, capacity gaps, and opportunities for technology adoption. A gender responsive assessment will be integrated to ensure that the needs and constraints of women processors—who play a central role in post harvest handling—are fully captured.

Based on the findings of the field assessments and consultations, the project will conduct a technical options analysis to evaluate the feasibility of transitioning to natural refrigerant technologies such as NH_3, CO_2, and HC 290. This analysis will consider safety requirements, energy efficiency potential, equipment availability, and long term sustainability. The preparatory phase will also explore the potential for integrating solar PV systems to reduce operational costs and improve resilience to power outages.

The results of these assessments will inform the development of a full project concept, including detailed components, expected outcomes, cost estimates, and an emissions reduction analysis. A monitoring and verification framework will be drafted to ensure that the project's impacts can be measured effectively. The preparatory phase will conclude with a validation workshop involving national stakeholders, after which the final project document will be submitted to the Multilateral Fund Secretariat.

The activities breakdown of this project is as follows:

Activity 1: Inception and Baseline Assessment

- Project Inception and Stakeholder Coordination.
- Comprehensive cold chains inventory assessment in fisheries (number of installations by type, capacity, refrigerants used, refrigerant servicing needs, energy consumption, quality, and production loss.
- Technical energy audits of selected locations for demonstration.

Activity 2: Field assessments and establishing baseline:

- Visit 5 selected demonstration fisheries cold chain sites
- Collect relevant data
- Work with beneficiaries to identify cooling demand profiles and usage patterns and
- Identify key inefficiencies, losses, and constraints.

Activity 3: Stakeholder Engagement

- Consult with fisheries cold chain stakeholders, RAC technicians and training institutions, and government and private-sector stakeholders
- Identify cooling requirements and key barriers
- Assess training and servicing gaps.

Activity 4: Technical and Economic Feasibility Analysis

- Technical options analysis for energy-efficient, low-GWP alternatives.
- Gender-responsive needs assessment.
- Feasibility study for renewable energy integration.

Activity 5: Development of Full Project Proposal

- Fishery sector's energy consumption and ice demand study.
- Fishery sector's baseline and project emission analysis.
- Formulation of project components, and budget.
- Conduct a stakeholder validation workshop.
- Finalization of Project Document for Submission.

Budget and timeline

A detailed budget is outlined in the table below. This PRP project is estimated to be implemented in 12 months. The follow-on EE project is estimated to be implemented in 24 months with an estimated budget of 1,100,000 USD, with a total cost to the MLF of 850,000 USD (considering a 250,000 cost share). The full proposal is expected to demonstrate:

- One energy-efficient, low-GWP flake-ice plants (5–10 tons/day)
- One energy-efficient, low-GWP block-ice plant (10–20 tons/day)
- One energy-efficient, low-GWP freezing tunnels (1–2 tons/hour),
- One cold rooms (0–4 °C)
- One freezing rooms (–18 °C)
- Management, training and awareness

82. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (USD)	Bilateral/ Implementing Agency
Inception, Coordination & Desk Review: Conduct a kick-off meeting with NOU and relevant stakeholder, perform relevant desk research on local and regional policies and initiatives, and develop a workplan.	5,000	UNDP
Field Assessments & Baseline: Visit selected demonstration sites (~5) and fisheries cold chains to collect relevant data. Work	10,000	UNDP

with beneficiaries to identify cooling demand profiles and usage patterns and identify key inefficiencies, losses, and constraints.		
Stakeholder Engagement: Consultations with minimarket and supermarket operators, RAC technicians and training institutions, and women in the workforce, and government and private-sector stakeholders. Identify cooling requirements and key barriers. Assess training and servicing gaps.	5,000	UNDP
Technical Analysis & Preliminary Design: Screen energy-efficient, low-GWP technology options. Perform preliminary sizing and configuration of systems for selected use cases and obtain potential quotes for CAPEX requirements.	5,000	UNDP
Project Formulation & Finalization: Define project components, outputs, and expected impacts, quantifying energy savings and emission reductions. Develop M&V framework and prepare an implementation plan. Define the training and capacity building approaches. And devise a replication strategy. Conduct a validation workshop with stakeholders and finalise submission to the Multilateral Fund Secretariat.	5,000	UNDP
TOTAL	**30,000**	**-**

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

FUNDING REQUEST FOR THE PREPARATION OF ENERGY EFFICIENCY PILOT PROJECT UNDER DECISION 91/65

Part I: Project information

Project title:	Preparation for a pilot project for the commercial sector cold rooms, with potential replication in the public sector	
Country:	Saint Vincent and the Grenadines	
Lead implementing agency:	UNDP	
Implementation period for the energy efficiency project:	12 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $)***
UNDP	Servicing	30,000 USD

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

N. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

83. Agency:	UNDP
84. Sector:	Refrigeration
85. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2024 ☐ **No**
86. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☐ **Yes**, please provide support letter _____ ☐ **No** ☒ **N/A**
87. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No** ☒ **N/A**
88. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	The project will directly contribute to Saint Vincent and the Grenadines' strategy to integrate HFC phase-down with national energy efficiency objectives.

89. Project Description

Background and Rationale

1. In 2024, the HFC consumption in Saint Vincent and the Grenadines (SVG) reached 20.58 MT. Of this total 3.92 MT corresponded to R-404A, which is the predominant refrigerant used in cold storage chambers in the commercial refrigeration subsector.
2. From a climate perspective, the impact is significant. According to the Anex F of the Montreal Protocol, the R-404A has a GWP of 3,921.6. By applying this factor, the country's total HFC consumption in 2024 represents approximately 45,975.40 CO2eqt, of which 15,372.67 CO2eqt is attributable to R-404A alone. This means that R404A accounts for roughly 33,4% of the total climate impact of HFC consumption in SVG, despite representing less than 20% of the total volume consumed.
3. This disproportionate impact reflects the very high GWP of R-404A and highlights the mitigation potential of targeting this refrigerant replacement. Furthermore, under the Kigali Amendment to the Montreal Protocol, countries, such as SVG, are committed to a gradual phase-down of HFC consumption, creating both regulatory momentum and access to technical and financial support for transitioning to low-GWP alternatives.
4. Therefore, a project focused on replacing R-404A in cold storage applications would generate substantial climate benefits, contributing directly to HFC phase-down targets, while also reducing indirect emissions from electricity consumption.
5. Cold storage chambers are particularly strategic in SVG's national context. They underpin critical value chains including agriculture, fisheries and food storage and distribution – sectors that are essential for food security, rural livelihoods and economic resilience in small islands developing states (SIDS).
6. Existing cold chambers typically feature:

    - Aging equipment with limited energy efficiency optimization
    - Centralized or split systems operating with R-404A
    - High leakage rates associated with older piping and servicing practices
    - Use of high GWP refrigerants.
    - Deteriorated thermal insulation.
    - Continuous operation due to high ambient temperatures in tropical climates, increasing electricity demand
    - Limited use of advanced control systems (e.g., variable speed drives or digital monitoring)

7. Given that commercial refrigeration systems using R-404A are also among the highest energy consumers within the cooling sector, transitioning to low GWP and energy-efficient alternatives (such as CO2 systems, R-290 or optimized HFO blends, where technically appropriate) would deliver dual benefits:

    - Direct emissions reductions through lower GWP refrigerants
    - Indirect emissions reductions through improved energy efficiency and lower electricity consumption – a critical factor in Caribbean islands where electricity generation is often fossil fuel based relatively costly.

8. This project will be focused on the commercial sector of SVG, particularly in hotel-based cold chambers. There is great potential to replicate this experience in other strategic sectors of the country, especially the public sector. It is estimated that about 30-40 hotels and 100 restaurants and about 10 fisheries and supermarkets could benefit for a project of these characteristics.
9. This creates a perfect opportunity for a project that combines energy efficiency plus transition to low-GWP refrigerants, aligned with the Kigali Amendment.
10. Moreover, the introduction of solar photovoltaic (PV) systems adds a crucial strategic dimension to the project. In SVG, approximately 95% of electricity generation is based on imported petroleum products, making the country highly vulnerable to international oil price volatility and external supply shocks. As a non-oil-producing SIDs, SVG's electricity generation costs are directly linked to global fuel prices, which translates into structurally high and fluctuating electricity tariffs.

11. As a result of this heavy fuel dependence, electricity tariffs in SVG are among the highest in the Caribbean. Hence, the importance of a project of this nature will support directly the energy matrix of the country.
12. The proposed Project Preparation Request (PRP) focuses on the hospitality sector and aims for them to transition to high-efficiency, HFC-free cooling technologies powered by renewable energy sources, thereby reducing reliance on costly, oil-based electricity generation.

Objective

54. Demonstrate the technical performance of cooling systems based on natural refrigerants as viable alternatives to HFC-based technologies under local climatic conditions
55. Demonstrate the safety and regulatory compliance of alternative technologies, including appropriate system design, adherence to international installation standards, optimized refrigerant charge sizes, and implementation of preventive maintenance protocols
56. Validate energy efficiency gains by comparing the performance of new natural refrigerant systems against existing (where applicable) HFC-based systems, quantifying reductions in electricity consumption and operating costs.
57. Strengthening national technical capacity for the safe handling, installation, servicing and maintenance of natural refrigerant through targeted training and institutional capacity building
58. Integrated advanced electronic controls and monitoring systems (e.g., smart controllers, variable speed drives, temperature optimization systems) to maximize operational efficiency and minimize energy consumption.
59. Deploy on-site renewable energy systems (solar PV) to reduce dependence on oil-based grid electricity, mitigate exposure to international fuel price volatility, and enhance long-term financial and environmental sustainability.

Scope of Activities

1. Project Inception and Coordination
Objective: Establish the operational framework for preparatory activities.
1.1. Formal kick-off with the National Ozone Unit (NOU).
1.2. Confirmation of institutional partners (hotels, fisheries, hospitals, others if any).
1.3. Definition of roles, responsibilities, and communication channels.
1.4. Development of a detailed schedule for field visits and data collection.

2. *Collection of Background Information and Documentation*
Objective: Compile all existing information relevant to cold-room infrastructure and energy use.
2.1. Review of national policies, energy tariffs, and institutional mandates.
2.2. Compilation of existing inventories, maintenance logs, and equipment lists.
2.3. Identification of previous interventions or donor projects related to refrigeration or energy efficiency.

3. *Field Assessments and Technical Data Gathering*
Objective: Obtain accurate baseline information to support the design of the full project.
3.1. Site visits to targeted institutions
- Hospitality sector (Mandarin Oriental, Bequia Beach Hotel, The Liming[2])
- National Fisheries Complexes.
- Other possible beneficiaries identified under the preparatory activities.

3.2. Technical assessment of existing cold rooms
- Physical condition of equipment and insulation.
- Identification of refrigerant type and approximate charge.
- Operational status and maintenance practices.

3.3. Preliminary energy consumption verification
- Collection of electricity bills.

[2] The final site chosen for the site will be assessed during the PRP phase.

- Estimation of cold-room energy use (direct measurement if feasible).
- Identification of operational patterns affecting load.

3.4. Safety and compliance review

- Assessment of risks associated with current refrigerants.
- Review of institutional readiness for low-GWP alternatives.

4. Stakeholder Consultations and Needs Assessment
Objective: Understand operational needs, constraints, and institutional expectations.

4.1. Interviews with facility managers, technicians, and procurement officers.
4.2. Identification of operational challenges (food storage, etc.).
4.3. Assessment of capacity gaps for future training components.
4.4. Validation of preliminary findings with each institution.

5. Technical Options Analysis and Preliminary System Design
Objective: Identify feasible technological pathways for the full project.

5.1. Evaluation of suitable refrigerants (R-290, CO_2, Ammonia, others).
5.2. Preliminary sizing of replacement systems based on measured loads.
5.3. Identification of energy-efficiency opportunities (insulation, controls, Variable Frequency Drive).
5.4. Assessment of infrastructure constraints including installation of solar cells for energy supply.
5.5. Preliminary cost ranges for equipment and installation.

6. Development of the Full Project Concept
Objective: Transform preparatory findings into a structured project proposal.

6.1. Definition of project objectives, components, and expected outcomes.
6.2. Drafting of the intervention logic (problem statement, barriers, justification).
6.3. Preliminary estimation of energy savings and emission reductions.
6.4. Identification of training needs and outreach components.
6.5. Drafting of the monitoring and verification approach.

7. *Budgeting and Financial Planning*
Objective: Prepare a cost structure for the full project.

7.1. Costing equipment, installation, logistics, and commissioning.
7.2. Estimation of training, workshops, and capacity-building costs.
7.3. Identification of co-financing sources.

8. *Validation and Finalization of the Project Document*
Objective: Ensure alignment with national priorities and MLF requirements.

8.1. Presentation of draft project concept to the NOU and key institutions.
8.2. Incorporation of comments and technical adjustments.
8.3. Finalization of the project document for submission to the MLF Secretariat.

Expected Results

The project is designed as a catalytic first step toward the broader adoption of natural refrigerant and renewable energy-based cooling technologies across SVG. By demonstrating technical feasibility, safety and cost-effectiveness in the hospitality sector, the initiative will create a strong evidence base to support replication in other high-impact subsectors, including fisheries complexes, supermarkets and other commercial establishments that provide similar services to the public and operate under comparable cooling loads.

Implementing the project in one of the most important economic sectors for the country ensures full engagement as well as flagship initiative that can be easily replicated in other sectors. Moreover, this approach guarantees system

design, installation standards, and operational practices, while allowing for controlled implementation, robust performance monitoring, and transparent documentation of results.

Importantly, the installation process, technical specifications, performance data and lessons learned will be systematically documented and disseminated to stakeholders – particularly operators of similar facilities – to encourage voluntary uptake and market transformation.

A comprehensive capacity building component will be embedded within the project. This will include:

- Training for National Ozone Unit (NOU) Staff to strengthen technical knowledge, monitoring and evaluation capabilities, and long-term oversight of natural refrigerant technologies.
- Practical hands-on training for technicians on the safe installation, servicing and maintenance of natural refrigerant systems.
- Specialized instruction on system diagnostics, safe handling procedures (including flammability considerations where applicable), leak detection and rapid fault resolution.
- Training on digital control systems and electronic monitoring tools to enable predictive and preventive maintenance approaches.

To ensure measurable and verifiable impact, the project will incorporate a structured monitoring and verification plan, tracking key indicators, before and after installation, including:

- Electricity consumption (kWh)
- Peak demand where relevant
- Refrigerant leakage rates
- System efficiency (e.g., coefficient of performance, where applicable)
- Maintenance frequency and operational costs

This data driven approach will allow the quantification of both direct and indirect emission reductions.

Finally, the project will include a robust technology dissemination and outreach strategy. This will involve technical workshops, stakeholder consultations and the development of guidance materials outlining recommended standards for design, installation, safety and maintenance of natural refrigerant systems. By promoting awareness of regulatory frameworks, international best practices, and demonstrated local results, the project will facilitate informed decision-making and accelerate replication across SVG's cooling-dependent sectors.

Potential Beneficiaries

Primary Institutional Beneficiaries

- Hospitality sector: 2 hotels will be chosen during the PRP phase as early-adopters of cooling solutions without HFCs, translated in energy efficiency gains, hence savings for the country.
- Fisheries complexes and supermarkets: as adopters of tailored cooling solutions without HFC, translated in energy efficiency gains.
- National Ozone Unit: gains a validated refrigerant usage matrix to guide Kigali Amendment compliance and future HFC phase-down strategies and demonstrable pilot to support the adoption of new technologies/alternatives
- Ministry of Education (Training centres) Refrigeration and Air-conditioning Technicians Association (RACTA) as repositories of the main information of the project: by learning and adopting safer practices to handle low-GWP refrigerants.
- Ministry of Health, Wellness and Energy (hospitals): gains from energy efficiency savings by adopting low-GWP technologies.
- Private Sector entities (Hoteliers and restaurateurs): gains from energy efficiency savings by adopting low-GWP technologies.

Sectoral and Technical Stakeholders

- Commercial RAC End-Users: Beneficiaries of the project, receive tailored recommendations for upgrading systems, reducing energy costs and accessing financing or incentives.
- Service Technicians and RAC Engineers: Benefit from training opportunities and clearer guidance on refrigerant handling, leak reduction, and energy-efficient retrofits.
- Importers, distributors, and equipment retailers: gain market intelligence to anticipate shifts in demand, stock alternative refrigerants and align with future regulations.
- Educational and Vocational Institutions: Can integrate findings into curricula for RAC certification, technician training and climate-smart engineering.

90. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (US $)	Bilateral/implementing agency
International and national technical consultancy to conduct technical feasibility assessment and prepare the full pilot proposal	20,000	UNDP
Site visits to facilities, collection of refrigerant and energy consumption data, cooling load assessment, preliminary engineering review, and data logging for baseline energy performance	5,000	UNDP
Consultation with selected beneficiaries, technical experts, and relevant authorities to validate technology options, and finalize the pilot design concept.	5,000	UNDP
TOTAL	30,000	

Preparatory Assistance for an Energy Efficiency Project in the Refrigeration and Air Conditioning Sector (94/60)

PROJECT CONCEPT – BRAZIL

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL
ENERGY EFFICIENCY EXCOM DECISION 94/60 (EE) PROJECT PREPARATION (PRP)
KIP (INV – REF)
KIP (INV – A/C)

• Part I: Project information

Project title:	Preparatory assistance for the Energy Efficiency Project in the Refrigeration and Air-Conditioning Sector	
Country:	Brazil	
Lead implementing agency:	UNDP	
Implementation period for stage RPR EE:	12 months	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the project proposal (please specify): 12 months		
Funding requested:		
Agency	Sector	Funding requested (US $)*
UNDP	INV - Others	165,000.00 USD

*Details should be consistent with information provided in the relevant sections below.

• Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

A. Information required for PRP funding request for investment projects/sector plans as part of Energy Efficiency Funding Window

1. Agency:	UNDP
2. Sector:	Refrigeration, Air-Conditioning
3. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and year: 2024 ☐ **No**
4. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☒**Yes**, please provide support letter ☐ **No** ☐ **N/A**
5. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☐ **Yes** ☐ **No** ☒ **N/A**

6. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	This project will support the transition of the room air conditioning and self-contained commercial refrigeration industry in Brazil to higher energy efficiency while phasing down HFC consumption.

7. Background information

The Government of Brazil, with the assistance of UNDP, is requesting project preparation funding to develop an energy-efficiency project in the light commercial refrigeration and room air-conditioning sectors under the operational framework for maintaining and/or enhancing energy efficiency in the context of the HFC phase-down, as approved by the Executive Committee in Decision 94/60. The project preparation will support the development of a detailed project proposal consistent with the operational framework, including baseline assessments, identification of energy-efficient low-GWP technologies, cost and incremental cost analysis, stakeholder consultations, and the preparation of an implementation, monitoring and verification framework.

The Kigali Amendment to the Montreal Protocol was approved by Legislative Decree No. 95/2022, ratified on October 19, 2022, and enacted through Decree No. 11,666 of August 24, 2023. This legislative framework established the national commitment to gradually phase down hydrofluorocarbons (HFCs). In line with this commitment, IBAMA Normative Instruction No. 29 of December 18, 2023, set the freeze level for national HFC consumption based on the established baseline. Brazil will initiate Stage I of its Kigali Implementation Plan (KIP) in 2027, prioritizing the refrigeration and air-conditioning sectors.

Brazil's refrigeration and air conditioning (RAC) sector is rapidly expanding and plays a strategic role in enabling residential comfort, commercial activity, and industrial productivity. Driven by unprecedented heat waves and increased demand for thermal comfort, the RAC market reached R$ 50.15 billion in 2025 (US$ 9.7 billion) and is projected to reach R$ 55.62 billion (US$ 10.76 billion) in 2026, reflecting growth across manufacturing, installation and maintenance activities. This expansion is driven by the sector's transition toward more energy-efficient and environmentally sustainable technologies, shaped by regulatory requirements and rising electricity consumption during extreme heat events. As a result, the RAC industry has become one of the most dynamic and economically relevant sectors in the country.

Brazil is currently the world's second-largest manufacturer of room air conditioners. In 2025, domestic production reached 6.8 million split-type units, with around 7 million units projected for 2026. The country hosts 22 manufacturers, all located in the Manaus Free Trade Zone, supplying the national market. By the end of 2026 it is possible to have 24 companies operating in Brazil. Among these, seven eligible companies (A5 enterprises with assembly lines established before 2023) have been identified as producers of split AC equipment. These companies are already converting their lines, at their own expenses, to transition from R-410A to HFC-32. Given this ongoing transition, HFC-32 is expected to remain the dominant refrigerant in the sector for the coming years. According to the National Association of Manufacturers of Electronic Products (Eletros), only 20% of Brazilian households currently own an air conditioner, and the product is also widely used in small commercial establishments. Considering the replacement of old HCFC-22-based units reaching end-of-life, production is expected to remain stable in a conservative scenario and grow by up to 10% in a positive scenario.

The commercial refrigeration sector plays a strategic role in the national cold chain for food, pharmaceuticals, and other temperature-sensitive products. It includes supermarkets, grocery stores, butcher shops, bakeries, restaurants, pharmacies, and convenience stores. The segment operates mostly with high-GWP HFCs, notably R-404A in low-temperature applications and HFC-134a in medium temperature systems. Light commercial refrigeration covers a wide array of self-contained factory-charged equipment such as beverage coolers, freezers, ice machines, beer dispensers, ice cream machines, display cases, and water dispensers, as well as remote systems and small cold rooms charged in the field. In 2025, the estimated installed stock was 6.7 million units, with a projected 20% increase by 2035. According to the survey conducted for the KIP, more than 116 enterprises operate in this segment, mostly concentrated in the Southern and Southeastern regions, where the refrigeration manufacturing supply chain is strongest. Out of the 116 companies it is estimated that 59 companies manufacture equipment that will be regulated under the proposed Minimum Energy Performance Standards (MEPS) and thus eligible for participation in this project.

Actions to avoid the use of high GWP HFCs have been in place since the implementation of the HPMP, when

enterprises were encouraged to eliminate HCFC while adopting low-GWP alternatives. Mainly through discouraging medium and high-GWP substitutes that would not be sustainable in the long term. Under KIP Stage I, targeted activities will support companies in the light commercial refrigeration sector to phase out HFC-134a and R-404A. This transition represents a key opportunity to enhance equipment performance and energy efficiency. Because low-GWP refrigerants are typically flammable, system redesign will be necessary, with manufacturers pursuing solutions that reduce refrigerant charge while maintaining or enhancing energy efficiency.

HFC Consumption

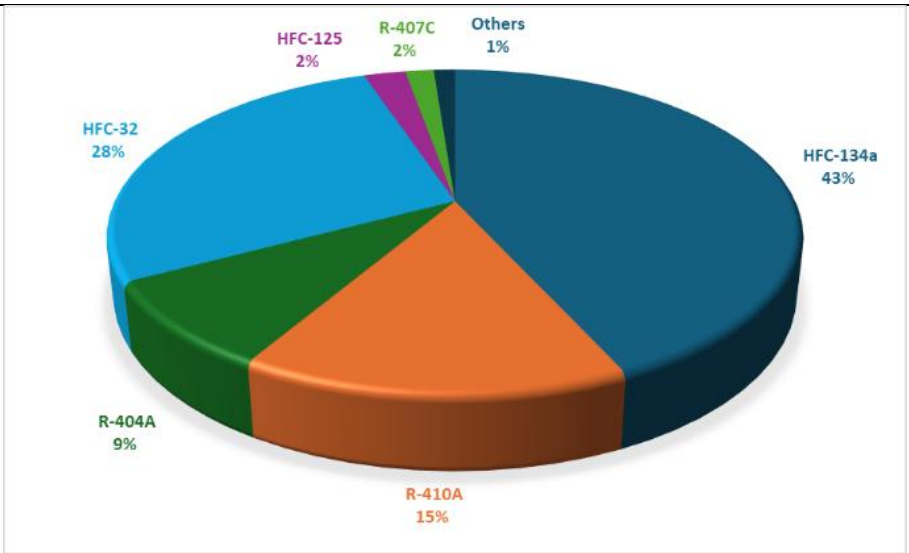
A comprehensive picture of Brazil HFC consumption is presented in the BRAZILIAN KIP – STAGE I. For 2024, Brazil reached 27,256.39 metric tonnes of HFC, corresponding to 43,693,160 CO_2-eq tonnes. Table 1 presents the past five years' HFC historic consumption and in Figure 1, the overview of HFC consumption.

Table 1 – Consumption of the main HFC and HFC blends between 2020 and 2024 (metric tonnes).

HFC / HFC blends	Year				
	2020	2021	2022	2023	2024
HFC-134a	8,909.98	9,084.27	15,538.92	10,101.56	11,765.19
R-410A	3,393.63	3,775.38	5,883.70	3,661.28	4,175.39
R-404A	2,253.83	2,425.44	5,606.01	1,222.04	2,370.05
HFC-32	1,776.02	2,869.60	4,144.23	2,738.46	7,540.55
HFC-125	1,556.70	2,855.58	4,213.88	1,015.44	636.52
R-407C	307.11	313.29	515.58	439.33	435.66
R-507A	43.58	65.71	187.65	5.10	111.64
R-438A	32.69	29.45	40.86	127.37	33.48
R-449A	7.72	19.52	44.49	39.50	46.99
HFC-152a	0.00	0.00	29.15	30.20	56.52
Others	550.30	1,123.93	1,524.92	666.11	84.40
Total	**18,831.56**	**22,562.17**	**37,729.39**	**20,046.39**	**27,256.39**

Source: MMA/IBAMA

Figure 1 – Overview of the percentage share of HFC and HFC blends consumption in Brazil, in 2024 (metric tonnes).



According to the BRAZILIAN KIP – STAGE I document, the room air conditioning HFC demand for the manufacturing was estimated at 3,222 metric tonnes of R-410A and 1,565 metric tonnes of HFC-32, while the refrigerant consumption in the service sector was estimated at 3,214 metric tonnes of R-410A and 228 metric tonnes of HFC-32.

For the light commercial refrigeration, it was estimated that 380 metric tonnes of HFC, of which 304 metric tonnes were HFC-134a and 76 metric tonnes were R-404A are used in the manufacturing sector. For the servicing sector, the annual demand was estimated at 380.1 metric tonnes, of which 268 metric tonnes was for R-404A, 106.4 t for HFC-134a, and 5.7 metric tonnes for other HFC.

REFRIGERATION AND AIR CONDITIONING STANDARDS

Brazil has progressively adopted regulations to support the transition to low-GWP refrigerants. The ABNT NBR ISO 5149—Brazil's translation of ISO 5149—serves as the primary national safety standard governing refrigeration and air-conditioning systems that operate with low-GWP, including flammable, refrigerants. Electrical safety standards applicable to the manufacturing of RAC equipment complement this regulatory framework and will also be addressed under KIP Stage I to ensure safety and performance requirements.

COMMERCIAL REFRIGERATION MEPS

Minimum Energy Performance Standards (MEPS) are coordinated by the Energy Efficiency Indicators Management Committee (CGIEE), chaired by the Ministry of Mines and Energy (MME). The CGIEE was established by Decree No. 4,059 of December 19, 2001, which regulated Law No. 10,295/2001, and later restructured by Decree No. 9,864 of June 27, 2019, which updated its composition and responsibilities.

International studies show that the electricity savings that would be achieved through MEPS and performance labeling in commercial refrigeration are comparable to those observed in the domestic refrigeration sector. Beyond the energy, environmental, and economic benefits, MEPS improves market transparency, strengthens competitiveness, and supports informed decision-making across the supply chain. Brazil projects a 44% increase in national electricity consumption between 2019 and 2029, reinforcing the urgency of advancing energy efficiency policies. These actions support Brazil's commitments under the Paris Agreement: a 37% reduction in GHG emissions by 2025 (relative to 2005 levels), a 43% reduction by 2030, and carbon neutrality by 2060.

Regulators worldwide are increasingly prioritizing commercial refrigeration due to its high energy saving potential. According to the Ministry of Mines and Energy, in Brazil, refrigeration equipment used for food conservation and

display accounts for approximately 50-60% of the electricity consumption of the average supermarket, underscoring its relevance for energy policy.

In 2021, the Ministry of Mines and Energy conducted a study involving market assessments, training, industry consultations, and laboratory testing. The study produced technical recommendations for MEPS, labeling, and performance seals for commercial refrigeration equipment. However, because the findings were consolidated at an aggregated level, a complete Regulatory Impact Analysis (RIA) is still required. This RIA—currently under development—is essential for defining minimum performance requirements and energy efficiency classes under the Brazilian Labelling Program (PBE). This action has been supported by the Montreal Protocol programme in Brazil. It will establish a robust, transparent conformity assessment methodology based on recognized test standards. Minimum energy performance requirements for commercial refrigeration equipment are expected to be formally established by the end of 2026.

Room Air Conditioning MEPS

Room air conditioners have been part of the Brazilian Labelling Program for decades. The National Program for the Conservation of Electric Energy (PROCEL) endorsement label was introduced for split units in 2004, followed by mandatory comparative labeling in 2006. The CGIEE Resolution No. 1/2022 significantly strengthened national MEPS by adopting the **Seasonal Cooling Performance Index (IDRS)**, based on ISO 16358, as the mandatory efficiency metric. The former EER metric, which only evaluated full-load performance, was replaced by IDRS/SEER, a more realistic seasonal metric that became mandatory for new models in 2024. The regulation provides clearer differentiation between inverter and fixed-speed technologies and includes a phased compliance schedule to support an orderly transition. Overall, these measures contribute to reduced electricity consumption, lower greenhouse gas emissions, enhanced consumer protection, and long-term environmental sustainability.

In February 2026, the CGIEE approved the regulatory agenda for the 2026–2028 period, which confirms the regulation of commercial refrigerators and the execution of studies and activities for updating the Minimum Energy Efficiency Indices for residential air-conditioning equipment.

Challenges and Opportunities

While Brazil has made commendable progress, challenges remain:

- Technical Barriers: Implementing MEPS for light commercial refrigeration equipment is in its early stages, and the proper enforcement of MEPS for all equipment requires a robust Monitoring, Reporting, and Verification (MRV) infrastructure. Challenges include limited technical expertise among manufacturers and OEM-imposed restrictions on appliance modifications.
- Equipment EE development: Companies need support to structure in-house test chambers and train their workforce to convert equipment and optimize energy efficiency during the conversion process.
- Certification: Adequately equipped laboratories will be required to conduct testing and certifications, especially in regions close to manufacturing facilities.
- Awareness and Compliance: Raising awareness among manufacturers, importers, technicians and consumers about the benefits of energy-efficient appliances and ensuring compliance with MEPS is crucial.
- Financial Constraints: Access to funding is essential for capacity building, data collection, and consumer awareness initiatives.

However, these challenges also present opportunities:

- Energy Savings and Emission Reduction: Strengthening MEPS for room air conditioning equipment and implementing and enforcing MEPS for commercial refrigerators can lead to substantial energy savings and greenhouse gas emission reductions; especially with an effective MRV mechanism.
- Economic Benefits: Promoting energy-efficient appliances can stimulate local manufacturing, create jobs, and reduce the cost of electricity for consumers.
- Regional Climate Leadership: Brazil can demonstrate its commitment to climate action by taking the lead

in energy efficiency.
- Workforce Qualification: enhancing workforce training for equipment conversion and improving energy efficiency will be key to obtaining these benefits.

Project Objectives
This preparatory project aims to lay the groundwork for strengthening energy efficiency in Brazil's self-contained commercial refrigeration and room air conditioner manufacturing sector by:

1. Establishing the manufacturing and technology baseline: for eligible enterprises, UNDP will collect the required data for establishing the market landscape including equipment capacities, energy efficiency, the refrigerants used, and the historical production volume. UNDP will also collect other enterprise-level information for the proposal development including the capacity for R&D, manufacturing capacity, and technology needs.
2. Country Assessment: Performing a detailed desk study on the Brazil cooling technology, cooling market, and relevant policies for energy efficiency.
3. Capacity Development:
    i. Train policymakers on energy efficiency matters and the dual environmental benefits when combined with the HFC transition
    ii. Train the stakeholders on the data collection process, the estimation of potential funding under different scenarios, and the data validation process.
    iii. Conduct workshops on energy efficiency improvement options and support beneficiaries to select the most cost-effective technologies based on their production scale and R&D capacity.
4. Project Document Development: Prepare a comprehensive project document outlining
    i. Project objectives and expected impact
    ii. Brazil's RACHP industry background
    iii. Participating enterprise background
    iv. Regulatory framework
    v. Institutional coordination between national ozone unit and energy efficiency authorities
    vi. Project cost details
    vii. Co-financing
    viii. Energy savings and indirect GHG emissions reductions
    ix. Commitments
    x. Project risks and mitigation mechanisms
    xi. Sustainability
    xii. Verification and reporting
    xiii. Requested funding
    xiv. Timeline for implementation.

Expected Outcome
The primary outcome of this project is to deliver a comprehensive and evidence-based project document that serves as a blueprint for synergistic activities in implementing energy efficiency projects while phasing down HFC to achieve the highest energy efficiency levels in Brazil's light commercial refrigeration and air conditioner manufacturing sector. This document will be instrumental in securing additional funding and guiding the implementation of comprehensive energy efficiency measures, ultimately leading to the following:

- Clear Roadmap for Energy Efficiency: The project document will provide a detailed action plan, encompassing technical assistance, and policy recommendations tailored to the specific needs and challenges of the Brazilian light commercial refrigeration and room air conditioner sectors.
- Enhanced Manufacturing Practices: By implementing the highest energy efficiency standards, the Brazilian light commercial refrigeration and room air conditioner will experience a significant transformation, producing appliances with superior energy performance so that the government can progressively advance current MEPS for room air conditioners and light commercial refrigeration appliances.
- Reduced Energy Consumption and Emissions: The widespread adoption of energy-efficient RAC equipment will result in substantial energy savings at both the household and commercial buildings; yielding significant national levels of energy savings. This in turn will contribute to reduced greenhouse gas emissions and a more sustainable energy landscape.

- Investment Attraction: The well-structured project document, backed by robust collected data and analysis, will serve as a compelling tool for attracting additional funding from investors, enabling the scale-up of energy efficiency initiatives in Brazil.
- Potential for Regional Impact: Brazil leadership in energy efficiency conversion through this project will create a path for regional impact through supporting neighbor countries and exporting higher performance equipment by acting as a regional center of excellency for the energy efficiency.

Key Deliverables
In addition to the Project Document, the following key deliverables will contribute to achieving the project's overarching outcome:

- Comprehensive Survey Data: Detailed information on the energy efficiency levels of rooms air conditioners and self-contained commercial refrigeration products manufactured in Brazil, providing a baseline for future improvements and calculating investment needed.
- Technical Analysis and Gap Assessment: Expert analysis of the survey data and identification of key gaps in technology, financing, and policy to guide the formulation of targeted interventions.
- Capacity Building and Knowledge Transfer: Successful completion of assessments, empowering stakeholders to actively contribute to the advancement of energy efficiency in the sector.

Project Activities

- Data Collection and Analysis: Collect and analyze data on the current market, potential beneficiaries, energy consumption patterns, and appliance stock to identify key challenges and opportunities.
- Stakeholder Consultations: Engage with industry representatives, government officials, and other relevant stakeholders to gather input and ensure broad support for the project document.
- Project Document Development: Prepare a comprehensive project document that outlines a clear roadmap for achieving energy efficiency goals in the sector.

Budget and Timeline
A detailed budget is outlined in the table below. This PRP project is estimated to be implemented in 12 months. The follow-on EE project is estimated to be implemented in 36 months.

Conclusion
This preparatory project is essential to establish a robust baseline and define an appropriate level of energy efficiency ambition for the room air-conditioning and self-contained commercial refrigeration sectors in Brazil, in line with the operational framework under ExCom Decision 94/60. Through targeted data collection, stakeholder engagement, and institutional strengthening, the project will enable the development of a technically sound and implementable EE proposal that maintains and/or enhances energy efficiency in the context of the HFC phase-down. The resulting framework will support the deployment of higher-efficiency technologies, contributing to sustained energy savings, reduced greenhouse gas emissions, and alignment with national climate and regulatory priorities.

8. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (US $)	Bilateral/ implementing agency
Stakeholder Engagement and Awareness Raising Conduct one national workshop and one webinar in collaboration with key stakeholders (e.g., ABRAVA, Eletros, relevant government institutions) to introduce the objectives of the energy efficiency (EE) preparatory project, present potential benefits and requirements under the EE framework (Decision 94/60) and engage participating manufacturers and stakeholders.	10,000	UNDP

Room air conditioning sector (split) survey and industry engagement: Conduct a detailed sector survey targeting manufacturers of split-type room air conditioners to collect data on production capacity, manufacturing processes, baseline energy performance, refrigerant use, and HFC consumption. Engage manufacturers through targeted bilateral meetings and technical discussions to identify feasible pathways for improving energy efficiency, including technology options, cost implications, and potential barriers.	$15,000	UNDP
Light commercial refrigeration survey and industry engagement: Conduct a comprehensive survey of the self-contained commercial refrigeration sector, including data collection on production lines, energy performance, refrigerant use, and HFC consumption.	$26,000	UNDP
Preparation of the Energy Efficiency Investment Project Document Prepare a comprehensive EE investment project proposal covering both the RAC and SCR sectors, in line with the operational framework under Decision 94/60. This includes technical, financial, and environmental analysis, as well as institutional and implementation arrangements.	$30,000	UNDP
TOTAL	**$81,000**	-

Preparation funding requests for HFC phase down Investment Projects

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL
STANDALONE HFC CONVERSION PROJECTS PREPARATION (PRP) WITH ASSOCIATED ENERGY EFFICIENCY TECHNICAL ASSISTANCE COMPONENT
DECISION 87/50
KIP (INV - REF)

Part I: Project information

Project title:	Advancing HFC Phase-down through conversion of two (2) commercial refrigerators manufacturers and aligning technical assistance support for energy efficiency performance piloting in India	
Country:	India	
Lead implementing agency:	UNDP	
Implementation period for stage I of the KIP:	2029-2032	
Duration of PRP implementation (i.e., time (in months) from the approval of PRP to submission of the KIP (please specify): 24 Months		
Funding requested:		
Agency	**Sector**	**Funding requested (US $) ***
UNDP	INV - REF	30,000
UNDP	INV - REF	30,000

*Details should be consistent with information provided in the relevant sections below.

Part II: Prerequisites for submission

Item	Yes	No
Official endorsement letter from Government, indicating the specifying roles of respective agencies (where more than one IA is involved)	☒	☐

O. Information required for PRP funding request for the overarching strategy of the KIP

20. Montreal Protocol compliance target to be met in ☒ stage I of the KIP			
Phase-out commitment (%)	**10%**	**Year of commitment**	**2032**
☐ **Servicing only**		☐ **Manufacturing only**	☐ **Servicing and manufacturing**

21. Brief background/description/information on approved relevant projects and multi-year agreements as follows:

- The current progress in implementation of any funded HFC-related project (enabling activities or stand-alone HFC investment projects)
- The current progress in ongoing HCFC phase-out management plan (HPMPs)
- Consideration of integrating HFC phase-down activities with HPMP activities taking into account previously approved HFC-related projects, if this information is available.

India ratified the Kigali Amendment to the Montreal Protocol on 27 September 2021. The Kigali Amendment came into force for India on 26 December 2021. As per the provisions of the Montreal Protocol, licensing system has been put in place before 26 March 2022. Data reporting on HFCs and blends containing HFCs is being done starting the year 2021

Regarding HCFC phase out, India has met the 2013, 2015, 2020 and 2025 compliance targets as per the accelerated phase out schedule of the Montreal Protocol through implementation of HPMP Stage-1, HPMP Stage-2 and HPMP Stage-3, as well as through the policy and regulatory framework put in place for HCFC phase out. India also complied with the provisions of agreement with the ExCom both HPMPs The Stage-3 of the HPMP approved in the 91st meeting of the ExCom of the MLF is under implementation, under which 2025 compliance targets for HCFCs have been achieved. Also, phase out of HCFCs in new manufacturing has been achieved as on 1.1.2025 Activities in the servicing sector will continue till 2030.

India does not have a full KIP under implementation, however, two (2) standalone HFC phase-down projects had been approved projects under ExCOM Decision 87/50 – one in commercial refrigeration sector and second in commercial Airconditioning sector have been implemented, for which project completion reports are under finalisation.
In addition, one (1) project titled "Design and development of a pilot scale energy efficient rotary compressor along with microchannel heat exchanger compatible to R-290 technology at Godrej & Boyce Mfg. Co. Ltd., for use in manufacturing of room air-conditioners" has been implemented under ExCOM Decision 91/65, for which project completion report is under finalisation

Once the KIP-I preparation activities start in India, the above aspects would be considered during development of overarching strategy for Stage-I of the KIP and also for any potential integration feasible between the HPMP-III and the KIP-I.

22. Overview of current HFC consumption in metric tonnes by substance (last three years)

Substance/blend	Sector	2022	2023	2024 **

Given the large quantity of HFCs consumed by India, data on HFCs for the years 2022, 2023 and 2024 is enclosed at **Annexure – II**

** Data for 2025 is under compilation

23. Based on the consumption data given above, please provide a description of the sector/sub-sector that use HFCs in the country, including a short analysis and explanation of the consumption trends (i.e., increasing or decreasing)

The over-arching analysis indicates that HFC consumption is predominantly driven by the refrigeration and air-conditioning manufacturing and servicing sectors**,** which account for the use of a wide range of gases including HFC-32, HFC-134a, HFC-125, and blends such as R-404A, R-407C, R-410A, and others. In addition to these core sectors, foam manufacturing also represents a significant area of application, utilizing gases like HFC-245fa, HFC-152a, and HFC-365MFC/227EA blends. The pharmaceutical sector has a specialized but important role, particularly through the use of HFC-134a and HFC-227ea in metered dose inhalers (MDIs).

Other niche applications include aerosols, solvents, firefighting, glass blowing, and chillers, along with emerging uses in research and development for new refrigerant blends such as R-454B**.** Overall, the data highlights that while cooling-related sectors dominate HFC usage, a diverse range of industrial and specialized applications contribute to the overall sectoral distribution.

HFC consumption shows a clear and accelerating upward trend over the period 2022–2024, increasing from 43,688 MT in 2022 to 48,772 MT in 2023 and further to 60,281 MT in 2024**,** reflecting an overall rise of about 38%**.** The growth is particularly sharp in 2024. The consumption pattern remains highly concentrated, with HFC-32, HFC-134a, HFC-125, and R-410A accounting for the bulk of usage.

Among these, HFC-32 exhibits the most significant increase**,** while HFC-125 shows a notable surge in 2024**,** and HFC-134a remains consistently high across all years. Blended refrigerants and newer HFC variants show gradual but comparatively lower contributions. Overall, the data indicates a steady expansion in both the volume and composition of HFC consumption during the period under review.

India has submitted the Country Programme consumption reports to the ExCOM for years 2021, 2022, 2023 and 2024 providing top-down consumption breakdown per manufacturing and servicing sector. However, detailed updated bottom-up sub-sector and application analysis of HFCs use/demand are expected to be fully developed during the preparation of the KIP I.

24. Description of information that needs to be gathered during project preparation. Explain how this data will be gathered

Information needed	Description	Agency

25. Activities to be undertaken for EE project preparation and funding (Decision 94/60)		
Activity	**Indicative funding (US $)**	**Agency**
TOTAL		

26. How will activities relate to preparing the KIP be linked to the current stages of the HPMP being implemented in the country? (OPTIONAL)
India has already phased out use of HCFCs in new manufacturing as on 1.1.2025
27. How will the Multilateral Fund gender policy be considered during project preparation?
In line with the decision 84/92, the operational policy on gender mainstreaming would be applied wherever feasible in the preparation of the proposed projects including in the following activities (a) Encouraging participation in the consultative meetings. (b) Promoting awareness to develop staff competency and awareness on gender mainstreaming as part of the consultation exercise. (c) Share experiences and lessons learned on gender mainstreaming.

P. Information required for PRP funding request for investment projects/sector plans as part of or in advance of the KIP

91. Agency:	UNDP
92. Sector:	Refrigeration
93. HFC consumption in item #2 reported under country programme data?	☒ **Yes**, please specify reported amount and 2024. ☐ **No**
94. Does the enterprise commit to phase out the HFC consumption associated with the proposed investment project, if approved by the Executive Committee?	☒ **Yes**, please provide support letter _ ☐ **No**
95. If the project preparation is requested in advance of the KIP, did the Government provide a written commitment that the consumption associated with these investment projects, once approved, will be deducted from the country's starting point, once established?	☒ **Yes** ☐ **No**
96. Please explain briefly how the investment project would relate to the overarching strategy for the country, and when the final KIP will be submitted (decision 87/50(e))	The proposed projects would provide good insights on the HFC phase down and demonstrating low GWP technologies including enhancement of energy efficiency. The experiences of these projects would help in the implementation of KIPs including in the development of overarching strategy.

97. Information on sector consumption (specify previous year HFC consumption)	
Substance	**Consumption (metric tonnes)**
Given the large quantity of HFCs consumed by India, consumption data on HFCs for the years 2022, 2023 and 2024 is enclosed at **Annexure – II** India has submitted the Country Programme consumption reports to the ExCOM for years 2021, 2022, 2023 and 2024 providing top-down consumption breakdown per manufacturing and servicing sector. However, detailed updated bottom-up sub-sector and application analysis of HFCs use/demand are expected to be fully developed during the preparation of the KIP I.	

98. Information on enterprise(s) for which funding is being sought

Enterprise	Year established	HFC consumption (metric tonnes) (last three years)			HFC phase-out to be achieved (metric tonnes and CO_2-eq. tonnes)
		2022	2023	2024	
Ultrakool	The information will be collected as part of the questionnaire to be developed for data collection and included in the project proposal for each enterprise.				
Birla AirCon					

99. Activities to be undertaken for preparation of the investment project and funding requested

Activity	Indicative funding (US $)	Bilateral/implementing agency
Data collection at companies' level for HFC conversion (including travel costs and third-party verification)	20,000	UNDP
Consultation with stakeholders including national and international experts time and travel costs	7,500	UNDP
Project design and consolidation with draft proposals, consolidate inputs from stakeholders, finalisation of the project proposal, translation and support during project review process with MLF.	12,500	UNDP
Consultation with nodal line ministries/departments, related stakeholders and finalisation of the project proposal	12,000	UNDP
Independent Peer Review	8,000	UNDP
TOTAL	**60,000**	

Annexure – 1

PROJECT 1: Conversion of manufacturing facility comprising blast freezers, walk in freezers and process chillers from R-404A and R-407C to R-290 and demonstrate enhancement in energy efficiency at M/s Ultrakool

The enterprise is a women-oriented SME specializing in high quality blast rooms, walk in freezers and process chillers for diverse industries including agriculture and health care.

The proposed project involves transition to R-290 from R-404A and R-407C, currently used refrigerants. Enhancement in energy efficiency will be demonstrated through an incremental Technical Assistance Component sought for developing prototypes to 15 units R-290 based units that would be certified through an accredited laboratory to be in line with the requirements of the Bureau of Energy Efficiency, the nodal organisation in the country for energy efficiency.

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The lessons will be useful for SMEs operating in the refrigeration and process chillers sector during implementation of the KIPs

PROJECT 2: Conversion of the manufacturing facility comprising display cabinet, water coolers, freezer on wheels, prototypes, and condensing units from R-134a to propane (R-290) and demonstrate enhancement in energy efficiency at M/s Birla Aircon Limited.

The enterprise is a SME operating in commercial refrigeration and room air-conditioning sectors. The enterprise manufacturers water coolers, display cabinets, visi coolers and chest freezers using R-134a and chillers using R-404A and R-134a.

The proposed project involves transitioning to propane (R-290) from R-134a, and R-404A currently used refrigerants. Enhancement in energy efficiency through an incremental Technical Assistance Component sought for developing prototypes for 15 units of R-290 based units at 15 clients, to be certified by an accredited laboratory to be in line with the requirements of the Bureau of Energy Efficiency, the nodal organisation in the country for energy efficiency.

Annexure – II

HFC 2022 Data

HFCs		Production	Import	Export	Consumption
HFC-32	Mt	9590.20	8994.68	2391.383	16193.497
	mt CO_2-eq	6473385	6071409	1614183.525	10930610.48
HFC-125	Mt	8754.751	122.26	4874.95	4002.061
	mt CO_2-eq	30641628.5	427910	17062325	14007213.5
HFC-134a	Mt	14727.82	9125.191	6112.542	17740.469
	mt CO_2-eq	21060782.6	13049023.13	8740935.06	25368870.67
HFC-152a	Mt		2940.478	4.970	2935.508
	mt CO_2-eq		364619.272	616.28	364002.992
HFC-227ea	Mt		263.973	0.415	263.558
	mt CO_2-eq		849993.06	1336.3	848656.76
HFC-236fa	Mt		72.584	0.155	72.429
	mt CO_2-eq		712049.04	1520.55	710528.49
HFC-245fa	Mt		1064.839	0	1064.839
	mt CO_2-eq		1096784.17	0	1096784.17
HFC-365MFC	Mt		38.4	0	38.4
	mt CO_2-eq		30489.6	0	30489.6
HFC-43-10mee	Mt		0.6	0	0.6
	mt CO_2-eq		984		984
HFC-23	Mt		0	0	0
	mt CO_2-eq		0	0	0
R-404A	Mt		1265.6	227.334	1038.266
	mt CO_2-eq		4963683.2	891603.948	4072079.252
R-407C	Mt		718.92	274.371	812.049**
	mt CO_2-eq		1275364.08	486734.154	1440574.926
R-407F	Mt		1.452		1.452
	mt CO_2-eq		2649.9		2649.9
R-410A	Mt		3887.67	4627.717	3814.326**
	mt CO_2-eq		8117454.96	9662673.096	7964312.688
R-426A	Mt		20	0	20
	mt CO_2-eq		30160		30160
R-438A	Mt		200	0	200
	mt CO_2-eq		452800		452800
R-467A	Mt		0	37.800	0
	mt CO_2-eq			51370.2	
R-454B	Mt		0.176	0	0.176
	mt CO_2-eq		81.84	0	81.84
R-454C	Mt		0.073	0	0.073
	mt CO_2-eq		10.585	0	10.585
R-455A	Mt		0.8	0	0.8
	mt CO_2-eq		116	0	116
R-513A	Mt		0.684	0	0.684
	mt CO_2-eq		430.236	0	430.236
HFC-365mfc/HFC-227ea	Mt		115.2	0	115.2
	mt CO_2-eq		132480	0	132480

**As per Article-7 and Country Programme Progress Report, no need to report the production of mixtures/blends. However, the consumption is calculated considering R-407C production= 367.5 MT and R-410A production= 4554.373 during the year 2022.

HFC 2023 Data

HFC		Production (MT)	Export (MT)	Import (MT)	Consumption (MT)
HFC-32	**MT**	11459.11	2856.496	8844.9	17447.514
	mt CO2-eq	7734899.25	1928134.8	5970307.5	11777071.95
HFC-41	**MT**	0	0	0.000025	0.000025
	mt CO2-eq	0	0	0.0023	0.0023
HFC-125	**MT**	10282.102	7126.832	373.975	3529.245
	mt CO2-eq	35987357	24943912	1308912.5	12352357.5
HFC-134a	**MT**	13476.12	5367.726	7701.665	15810.059
	mt CO2-eq	19270851.6	7675848.18	11013380.95	22608384.37
HFC-227ea	**MT**	0	5.07	308.626	303.556
	mt CO2-eq	0	16325.4	993775.72	977450.32
HFC-152a	**MT**	0	0	4502.914	4502.914
	mt CO2-eq	0	0	558361.336	558361.336
HFC-245fa	**MT**	0	0	1772.705	1772.705
	mt CO2-eq	0	0	1825886.15	1825886.15
HFC-236fa	**MT**	0	0.52	84.908	84.388
	mt CO2-eq	0	5101.2	832947.48	827846.28
HFC-365MFC	**MT**	0	0	19.8	19.8
	mt CO2-eq	0	0	15721.2	15721.2
HFC-43-10mee	**MT**	0	0	0.9	0.9
	mt CO2-eq	0	0	1476	1476
R-404A	**MT**		239.016	1294.8	1055.784
	mt CO2-eq		937420.752	5078205.6	4140784.848
R-407C	**MT**		492.533	538.776	598.943
	mt CO2-eq		858977.552	939625.344	1044556.592
R-410A	**MT**		5922.993	3492.061	2971.608
	mt CO2-eq		12367209.38	7291423.368	6204717.504
R-426A	**MT**		0	40	40
	mt CO2-eq		0	60320	60320
R-438A	**MT**		0	260	260
	mt CO2-eq		0	588640	588640
R-448A	**MT**		0	5.896	5.896
	mt CO2-eq		0	8171.856	8171.856
R-449A	**MT**		0	0.999	0.999
	mt CO2-eq		0	1394.604	1394.604
R-454B	**MT**		0	0.521	0.521
	mt CO2-eq		0	242.265	242.265
R-454C	**MT**		0	0.184	0.184
	mt CO2-eq		0	26.68	26.68
R-508B	**MT**		0	1.278	1.278
	mt CO2-eq		0	8700.624	8700.624
R-513A	**MT**		0	1.368	1.368
	mt CO2-eq		0	860.472	860.472
HFC-365mfc/HFC-227ea* (87%/13%)	**MT**		0	364.8	364.8
	mt CO2-eq		0	419520	419520

*As per Article-7, no need to report the production of mixtures/blends. However, the consumption is calculated considering R-407C production= 552.70 MT and R-410A production= 5402.540 during the year 2023.

HFC 2024 Data

HFC		Production (MT)	Export (MT)	Import (MT)	Consumption (MT)
HFC-23	**MT**	0	0	18	18
	mt CO2-eq	0	0	266400	266400
HFC-32	**MT**	23583.22	4841.093	4678.462	23420.589
	mt CO2-eq	15918673.5	3267737.775	3157961.85	15808897.58
HFC-125	**MT**	9177.708	2943.3	2006.231	8240.639
	mt CO2-eq	32121978	10301550	7021808.5	28842236.5
HFC-134a	**MT**	13739.15	4301.421	5901.916	15339.645
	mt CO2-eq	19646984.5	6151032.03	8439739.88	21935692.35
HFC-227ea	**MT**	0	3.083	266.983	263.9
	mt CO2-eq	0	9927.26	859685.26	849758
HFC-152a	**MT**	0	0	5186.489	5186.489
	mt CO2-eq	0	0	643124.636	643124.636
HFC-245fa	**MT**	0	0	349.5	349.5
	mt CO2-eq	0	0	359985	359985
HFC-236fa	**MT**	0	1.27	101.48	100.21
	mt CO2-eq	0	12458.7	995518.8	983060.1
HFC-43-10mee	**MT**	0	0	3.948	3.948
	mt CO2-eq	0	0	6474.72	6474.72
R-404A	**MT**		348.793	2596.906	2248.113
	mt CO2-eq		1367966.146	10185065.33	8817099.186
R-407C	**MT**		384.448	82.56	505.852
	mt CO2-eq		670477.312	143984.64	882205.888
R-410A	**MT**		6959.709	1089.02	4291.109
	mt CO2-eq		14531872.39	2273873.76	8959835.592
R-438A	**MT**		0	120	279.7
	mt CO2-eq		0	271680	633240.8
R-449A	**MT**		0	7.042	7.042
	mt CO2-eq		0	9830.632	9830.632

R-449C	**MT**		0	1.298	1.298
	mt CO2-eq		0	1622.5	1622.5
R-454B	**MT**		0	8.596	8.596
	mt CO2-eq		0	3997.14	3997.14
R-507A	**MT**		0	14.49	14.49
	mt CO2-eq		0	57742.65	57742.65
R-508B	**MT**		0	0.84	0.84
	mt CO2-eq		0	5718.72	5718.72
R-513A	**MT**		0	0.938	0.938
	mt CO2-eq		0	590.002	590.002
HFC-365mfc/HFC-227ea	**MT**		38.4	0	0
	mt CO2-eq		44160	0	0

***As per Article-7 and Country Programme Progress Report, no need to report the production of mixtures/blends. However, the consumption is calculated considering R-407C production= 807.740 MT, R-410A production= 10161.798 and R-438A production=159.70 MT during the year 2024.**