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ESPAÑOL
ORIGINAL: INGLÉS

COMITÉ EJECUTIVO DEL FONDO MULTILATERAL
PARA LA APLICACIÓN DEL
PROTOCOLO DE MONTREAL
Trigésima séptima Reunión
Montreal, 17 al 19 de julio de 2002

PROPUESTA DE PROYECTO: BRASIL

Este documento consta de los comentarios y recomendaciones de la Secretaría del Fondo sobre la siguiente propuesta de proyecto:

- Plan nacional de eliminación gradual de CFC — PNUD

HOJA DE EVALUACIÓN DEL PROYECTO
BRASIL

SECTOR: Eliminación gradual Uso de SAO en el sector: No se aplica

Umbrales de costo-eficacia en el subsector: No se aplica

Título del proyecto:

a) Plan nacional de eliminación gradual de CFC

Datos del proyecto	**Plan de eliminación de CFC**
Consumo de la empresa (toneladas PAO)	9.276
Impacto del proyecto (toneladas PAO)	5.801.00
Duración del proyecto (meses)	60
Monto inicial solicitado ($EUA)	
Costo final del proyecto ($EUA):	
Costo de capital adicional a)	
Gastos imprevistos b)	
Costos de explotación adicionales c)	
Costo total del proyecto (a+b+c)	42.568.640
Propiedad local (%)	100%
Componente de exportación (%)	0%
Monto solicitado ($EUA)	11.557.130
Relación de costo-eficacia ($EUA/kg.)	
¿La contraparte confirmó la financiación?	Sí
Organismo nacional de coordinación	Prozon
Organismo de ejecución	PNUD

Recomendaciones de la Secretaría	
Monto recomendado ($EUA) Impacto del proyecto (toneladas PAO) Relación de costo-eficacia ($EUA/kg) Gastos de apoyo del organismo de ejecución ($EUA)	
Costo total para el Fondo Multilateral ($EUA)	

DESCRIPCIÓN DEL PROYECTO

Objetivo

1. En nombre del Gobierno de Brasil, el PNUD ha presentado en la Trigésima séptima Reunión un plan nacional de eliminación de CFC. El objetivo del plan es asistir al Gobierno de Brasil a cumplir con sus objetivos de cumplimiento del año 2005 para las sustancias del Anexo A Grupo I y concluir la eliminación de esas sustancias para el 1° de enero de 2007. Se eliminará gradualmente un total de 9.276 toneladas PAO. Esta cantidad se compone de 3.475 toneladas PAO de CFC-11 y CFC-12, la cual ya ha sido planteada mediante proyectos aprobados pero que aún no se han ejecutado y 5.801 toneladas PAO adicionales que se abordarán mediante nuevas medidas propuestas en el plan. La rentabilidad general de las nuevas medidas que se proponen en el plan es $EUA 7,34 por kilogramo.

Estrategia de ejecución

2. Se adjunta al presente documento una copia de esta estrategia. (Anexo A.)

3. En el plan nacional de eliminación gradual se usará una serie de instrumentos, incluidos proyectos de inversión y actividades sin inversión, así como una combinación de medidas de apoyo para la definición de criterios y reglamentaciones para manejar la oferta y la demanda de CFC. En Brasil ya está lista la legislación que reduce las cuotas de importación de CFC-12 a cero para el 1° de enero de 2007. Se propone una acción anticipada para reducir el consumo en los sectores de manufactura y de servicio y mantenimiento, de forma que la demanda no supere la oferta. El calendario propuesto para la reducción en el consumo de CFC se adelanta al calendario de control del Protocolo de Montreal.

Componentes del plan

4. Se regulará la cantidad de CFC permitida en el país mediante controles de importación. La producción de CFC se detuvo en Brasil en 1999.

5. Para reducir la demanda, el plan propone:

a) Conclusión de la ejecución de los proyectos de inversión en curso financiados por el Fondo Multilateral (3.475 toneladas PAO).

b) Financiación para las nuevas actividades de inversión consistentes con los reglamentos del Fondo para concluir la eliminación en todos los sectores de manufactura, incluidos dos fabricantes nacionales de inhaladores de dosis media.

c) Financiación de capacitación técnica y recuperación/reciclaje en el sector de refrigeración y recuperación/reciclaje para el sector de equipo de aire acondicionado de vehículos y el sector de enfriadores.

d) Financiación de asistencia técnica para el sector de inhaladores de dosis media.

e) Financiación para dos programas de incentivos destinados a promover el retiro del equipo y los enfriadores existentes que dependen de CFC de los usuarios finales.

Costo del plan nacional de eliminación gradual

6. El costo total solicitado para la ejecución del plan nacional de eliminación gradual es de $EUA 42.568.640, con las siguientes componentes recomendadas por el PNUD:

Actividades	Núm. de empresas	Toneladas PAO	Cantidad solicitada, $EUA
Componente de asistencia técnica para el sector de los inhaladores de dosis media			478.500
Componente de asistencia técnica/inversion para 2 fabricantes nacionales de inhaladores de dosis media	2	<4,0	960.000
Eliminación gradual de CFC-113 en el sector de disolventes	?	29,0	551.000
Eliminación gradual de CFC-113 en el sector de esterilizantes	?	25,0	600.000
Eliminación gradual de CFC en el sector de espumas:			
Espumas de poliuretano rígido	?	10,0	78.300
Espuma de revestimiento integral	?	10,0	168.600
Espuma de poliuretano flexible	?	34,0	211.820
Subsector múltiple	?	20,0	190.600
Polietileno/poliestireno (CFC-12)	?	537,0	4.414.140
Total		611	5.063.460
Eliminación gradual de CFC en el sector de manufactura de refrigeración comercial	>49	142	2.159.820
Sector de servicio y mantenimiento de refrigeración doméstica y comercial:			
Programa de capacitación de técnicos			5.968.790[1]
Proyecto de recuperación de CFC-12			6.520.800
Centros regionales de reciclaje/ regeneración de CFC-12			3.880.000
Total			16.369.590
Proyecto de pago de incentivos a usuarios finales de refrigeración comercial			4.180.000
Proyecto de recuperación y reciclaje de equipo de aire acondicionado de vehículos			1.976.400
Proyecto de recuperación y reciclaje de CFC en el sector de servicio y mantenimiento de enfriadores centrífugos			1.163.670
Proyecto de pago de incentivos a usuarios finales de enfriadores centrífugos			6.146.000
Unidad de ejecución y supervisión del proyecto			2.695.000
Programa de capacitación aduanera			225.200
TOTAL			42.568.640 [2]

[1] Para su aplicación por el Gobierno de Alemania.
[2] Excluyendo todos los gastos de apoyo de los organismos.

Ejecución y gestión del plan

7. Se propone establecer una Unidad de Ejecución y Supervisión del Proyecto para proporcionar al Gobierno el apoyo necesario a fin de llevar a cabo las actividades que se proponen en este plan. La Unidad emprenderá, ella misma, las actividades asociadas con la ejecución del proyecto y la concientización del público. Además, la Unidad ayudará a la dependencia del ozono del Gobierno, PROZON, con actividades reguladoras y de supervisión, incluida la capacitación de una unidad de supervisión e imposición independiente de PROZON que se propuso. Después del año 2007, PROZON llevará a cabo todas las tareas restantes.

Financiación y desembolso

8. El Gobierno de Brasil busca la aprobación, en principio, de la financiación total solicitada, cuyo desembolso se propone en seis partes anuales, dependiendo del logro de un calendario de objetivos nacionales de consumo de CFC. El Gobierno también solicita máxima flexibilidad a fin de poder adaptar o modificar sus estrategias durante la ejecución, en caso de necesidad.

Auditoría y supervisión

9. Con la asistencia de la Unidad de Ejecución y Supervisión del Proyecto, la dependencia del ozono del Gobierno, PROZON:

a) Preparará un informe anual sobre la marcha de las actividades de la ejecución general del plan, de acuerdo con todos los procedimientos del Comité Ejecutivo para esta tarea.

b) Actualizará, cada año, los datos de consumo a nivel de usuario final y preparará una estrategia mejorada de ser necesario.

c) Preparará los informes sobre la marcha de las actividades y los planes anuales de trabajo para su presentación al Comité Ejecutivo.

d) Mantendrá un buen registro de todos los gastos en los que incurra este proyecto.

COMENTARIOS Y RECOMENDACIONES DE LA SECRETARÍA

COMENTARIOS

10. La Secretaría revisó en detalle el plan y ofreció extensos comentarios iniciales al PNUD, en dos documentos que comprenden 17 páginas de comentarios. El PNUD dio respuesta detallada a los comentarios en dos documentos que constan de 44 páginas. Los documentos completos están disponibles de solicitarlos a la Secretaría. La respuesta, si bien exhaustiva, fue de naturaleza explicativa. No se propusieron cambios al plan y no se ofreció información adicional sustancial además de las propuestas para auditar el desempeño. A continuación se presenta un resumen de los temas tratados y de la posición del PNUD en torno a ellos.

Consumo

11. En el plan se indica que Brasil solicitará financiación de conformidad con la Decisión 35/57 y con el punto de partida determinado en la Opción 2. La cifra acordada por el Comité Ejecutivo para la Opción 2 para Brasil es 6.228,9 toneladas PAO. En el plan, el Gobierno de Brasil ha indicado que considera que esta cifra es errónea y propone una cifra para el punto de partida de 6.446 toneladas PAO, es decir, un aumento de 217 toneladas PAO. El cálculo de la Secretaría se basa en los datos proporcionados por los organismos de ejecución en los informes sobre la marcha de las actividades. Sin embargo, el PNUD cree que, en virtud de los reglamentos de elaboración de los informes sobre la marcha de las actividades de proyectos que no están concluidos, la eliminación gradual pudo haber ocurrido incluso en caso de que ésta no haya sido dada a conocer.

12. La Secretaría tomó nota de que, si bien se informó sobre los datos del consumo sectorial, las investigaciones fueron preliminares. Existe insuficiente detalle de las empresas, sus fechas de establecimiento, sus actividades y sus consumos básicos para corroborar los niveles de consumo que se indicaron y la admisibilidad del consumo en relación con la capacidad de producción antes de 1995. Éste fue especialmente el caso en el sector de servicio y mantenimiento, donde los niveles de consumo parecieron mayores a las normas que surgen de varios indicadores. Al respecto, la respuesta que dio el PNUD no abordó las inquietudes mencionadas en los comentarios de la Secretaría. La Secretaría también indicó que algunas de las cantidades incluidas en el consumo pueden ser atribuidas a reservas.

13. En relación con el consumo usado en la capacidad de producción instalada después del 25 de julio de 1995, el PNUD indicó que las investigaciones detalladas, que se llevarán a cabo después de la aprobación como parte de la ejecución del plan, establecerían la fecha de instalación de la capacidad de producción. El PNUD señaló que en el plan se tomaron en consideración todas las reglas y políticas pertinentes del Comité Ejecutivo a seguir cuando las empresas fueron evaluadas para determinar su admisibilidad a la financiación para la conversión como parte del proceso de ejecución. En cuanto a la propuesta de que la financiación debe basarse sólo en el consumo admisible, el PNUD informó que:

> "Una interpretación estrecha, en nuestra opinión, sería afirmar que el plan nacional de eliminación sólo puede basarse en empresas admisibles e implicaría que las actividades nacionales sin inversión se "pagarían" mediante el uso de CFC por estas empresas solamente. Esto llevaría a una reducción (adicional) artificial de los umbrales de costos aplicables. En consecuencia, estas empresas estarían mucho mejor con un enfoque convencional individual o de grupo y el mérito del planteamiento sobre el desempeño del plan nacional de eliminación queda completamente invalidado: incluso se le transforma en un castigo".

14. Además, el PNUD informó que, en el sector de refrigeración comercial, las empresas establecidas después de 1995 han sido excluidas. Sin embargo, el PNUD también comunicó que "la financiación se basa en la información disponible relativa al consumo". La Secretaría toma nota de que se ha usado el consumo sectorial total disponible dentro del punto de partida de la Opción 2 de Brasil para calcular los costos adicionales, sin importar si lo usan o no empresas con capacidad de producción instalada después de 1995.

Cálculo de los costos adicionales para las actividades de inversión

a) Manufactura de inhaladores de dosis media

15. Además de la producción sustancial de las empresas no pertenecientes al Artículo 5, las empresas locales producen alrededor de 80.000 unidades de inhaladores de dosis media en Brasil. Esto corresponde a un consumo admisible de unas 2 toneladas PAO. El plan solicita $EUA 0,96 millones para dos proyectos de inversión, una rentabilidad de $EUA 480 por kilogramo. Al momento, no hay directrices contra las cuales pueda evaluarse la solicitud.

b) Sectores de disolventes y esterilizantes

16. Se propone un consumo total de 54 toneladas PAO para financiación, al promedio de los proyectos de Brasil de $EUA 19,00 por kilogramo para 29 toneladas PAO de CFC-113 en el sector de disolventes, y a una rentabilidad de $EUA 24/kg para una cantidad estimada de 25 toneladas PAO de CFC-12 que pueden usarse para esterilización. El PNUD indicó que la cifra de 25 toneladas fue un cálculo estimado “en ausencia de datos verificados”.

c) Sector de espumas

17. La base que se usó para el cálculo de los costos del proyecto del sector de espumas se está discutiendo con el PNUD. El sector comprende dos empresas muy grandes que consumen CFC-12 para la fabricación de espuma de polietileno expandido/poliestireno expandido. El consumo total de estas empresas es 537 toneladas PAO, lo cual representa el 88% del consumo admisible restante en el sector de espumas. Se propone la conversión de estas dos empresas para un umbral del subsector de $EUA 8,22/kg y un costo total de $EUA 4,4 millones. No se ha proporcionado información adicional del proyecto para estas dos actividades. Se han aprobado para Brasil sólo tres proyectos en este subsector, por un total de 180 toneladas PAO, y uno de los tres se canceló después de que se determinó que la empresa se había establecido en 1997. Empresas de esas dimensiones, de establecerse como admisibles para financiación, necesitarán cumplir con los reglamentos del Fondo para el cálculo de los costos adicionales para conversión. Dado su tamaño, es probable que resulten costos adiciones aproximados de 50% el nivel de umbral (es decir, unos $EUA 4,00 por kilogramo).

18. El PNUD respondió que, ya que éste es un plan sectorial en el marco de la Decisión 35/57, los costos adicionales deben determinarse sobre la base de un consumo sectorial y de cifras de la rentabilidad general promedio para el sector de espumas en Brasil, y no a nivel de subsector. Por consiguiente, el PNUD no tenía claro por qué se le pidió esa información sobre las empresas individuales.

19. La metodología propuesta por el PNUD no es consistente con la Condición B de la Decisión 35/57 que exige que “en todos los aspectos se mantendría la directriz existente en relación con la admisibilidad de proyectos”. La Secretaría toma nota de que se usó el cálculo de los costos del subsector en la revisión de los niveles de financiación para el sector de espumas en los planes para China, Malasia y Tailandia.

d) Refrigeración comercial

20. La financiación solicitada de $EUA 2.159.820 para hacer la conversión de los fabricantes restantes se calcula para todo el consumo subsectorial propuesto, usando el umbral de rentabilidad para el subsector de $EUA 15,21/kg. La Secretaría considera que esto no es consistente con los reglamentos y políticas del Fondo y está discutiendo la cuestión con el PNUD.

e) Servicio y mantenimiento de refrigeración y recuperación/reciclaje

21. Se solicita un total de $EUA 16,4 millones. De éste, se propone un programa de capacitación del sector de servicio y mantenimiento de refrigeración de $EUA 5.97 millones que la Sociedad Alemana de Cooperación Técnica pondrá en práctica como cooperación bilateral del Gobierno de Alemania, en partes consistentes con el límite de contribución bilateral de Alemania del 20%.

22. Se destacaron anteriormente las inquietudes de la Secretaría sobre las cantidades de CFC-12 que se indicó están siendo usadas en el servicio y mantenimiento. La Secretaría también discutió con el PNUD la validez de basar los programas de capacitación y los de recuperación/reciclaje en el cálculo de que hay 60.000 técnicos operando en el país. La base principal para este cálculo pareció ser la información que circuló en una revista técnica publicada en Brasil por un gran fabricante de compresores, Embarco. El PNUD comentó que "datos más precisos indican que sólo 5.000 técnicos están directamente empleados por los talleres de los fabricantes de equipo original". El resto son talleres muy pequeños que, frecuentemente, brindan poca o ninguna educación. El PNUD comentó que el Gobierno de Brasil, el PNUD y la Sociedad Alemana de Cooperación Técnica creen, todos, que estos números representan la mejor base para evaluar el tamaño y los costos adicionales del programa de capacitación propuesto.

23. El tamaño y el costo de esta parte del plan sigue discutiéndose con el PNUD.

f) Proyectos de recuperación y reciclaje de equipos de aire acondicionado de vehículos y de enfriadores

24. Se solicita un total de $EUA 3,1 millones para estos dos programas. Los datos básicos de las empresas, los costos de equipo y alcance general de los proyectos siguen en discusión.

g) Esquemas de incentivos a usuarios finales para los sectores de refrigeración y enfriadores ($EUA 4,18 millones y $EUA 6,146 millones)

25. Con respecto al programa de los enfriadores, desde la 12ª Reunión no se ha aprobado ningún proyecto de retroadaptación de enfriadores y la Secretaría no tiene bases para recomendar la aprobación de esta componente del plan. Además, no se ha ofrecido ninguna base o justificación para establecer la magnitud y el costo de la actividad. Con relación a la sustitución, los enfriadores modernos han sido muy eficientes en términos de consumo de energía, en comparación con los enfriadores viejos. Los ahorros en los costos adicionales de explotación son muy altos, lo cual genera, usualmente, pocos o ningunos costos adicionales. Los programas de sustitución de enfriadores en México y en Tailandia han sido financiados por el Fondo

Multilateral usando mecanismos de préstamo. El PNUD comentó que éste fue un programa de incentivos y que el nivel de pagos de incentivos fue considerado modesto en comparación con el costo de la retroadaptación y una fracción del costo de sustitución. La propuesta está destinada a facilitar la eliminación gradual de 88 toneladas PAO con una rentabilidad de $EUA 69/kg.

26. En forma semejante, el plan no proporciona ninguna base para el costo propuesto del proyecto de refrigeración para usuarios finales, el cual se dirige a facilitar la eliminación gradual del consumo total en el sector de servicio y mantenimiento de refrigeración (a excepción de los equipos de aire acondicionado de vehículos) que se indica es de 4.197 toneladas PAO. No puede determinarse la rentabilidad porque otros programas de asistencia técnica también considerarán este consumo.

Distribución de la financiación y desempeño

27. En los primeros dos años y medio, se propone el gasto de más de $EUA 41 millones. La eliminación gradual a partir de las actividades consideradas en el plan en el mismo periodo es de aproximadamente 340 toneladas. La Secretaría preguntó cómo podría manejarse este nivel de ejecución y gastos y qué tipo de garantías, incluidas sanciones pecuniarias como las incluidas en otros planes de eliminación gradual -como los de Turquía- podrían proponerse para garantizar que el Fondo se proteja en caso de que se retrase la ejecución o si los elementos del programa no resultan tener éxito. El PNUD informó que dadas las intenciones del Gobierno de Brasil de usar medidas legislativas para reducir las importaciones de CFC a cero para el 1° de enero de 2007, era difícil saber qué garantías adicionales pueden requerirse. El PNUD no abordó la cuestión de las sanciones al incumplimiento.

28. En relación con la capacidad para manejar el nivel de ejecución y gastos en estos primeros dos años y medio, el PNUD indicó que Brasil tiene unas de las oficinas de país más grandes del PNUD y que varias instituciones nacionales han participado plenamente en la preparación del plan y serían llamadas a participar como socios para desarrollar las funciones específicas que se determinen.

Responsabilidad para la ejecución y supervisión

29. El PNUD ha ofrecido agregar lo siguiente a la sección sobre ejecución y supervisión: “El PNUD comisionará, cada año, dos auditorías. Se llevará a cabo una auditoría financiera de la cuenta de eliminación gradual de CFC de acuerdo con los procedimientos internos del PNUD y se realizará una verificación del desempeño de los objetivos del Programa Anual de conformidad con procedimientos específicos del PNUD. La verificación anual del desempeño confirmará que el plan nacional de eliminación gradual de CFC ha sido ejecutado según los indicadores de desempeño pactados, incluida la cantidad total de eliminación de CFC y el nivel de consumo restante de CFC”.

30. Las funciones del Gobierno de Brasil y del PNUD necesitan elaborarse más en cuanto a la supervisión y la elaboración de informes. Este aspecto está en discusión entre la Secretaría y el PNUD.

Gastos de apoyo

31. Los gastos de apoyo no han sido abordados en el plan según se presenta. Este asunto se encuentra en discusión.

Programa anual de ejecución y proyecto de acuerdo

32. Junto con el plan no se proporcionó un primer programa anual de ejecución ni un proyecto de acuerdo. El PNUD ha indicado que preparará un proyecto de acuerdo. Al momento de la preparación de este documento, no se ha recibido dicho proyecto de acuerdo.

RECOMENDACIONES

33. Pendientes.

ANNEX A

37th Meeting of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY	BRAZIL	**LEADING IMPLEMENTING AGENCY:** UNDP
PROJECT TITLE	National CFC Phase-out Plan	
PROJECT IN CURRENT BUSINESS PLAN		Yes
SECTOR/SUBSECTOR		All that use CFCs
CONSUMPTION		
Baseline (1995-1997 average)		10,521 ODP tons
Current Consumption (2000)		9,276 ODP tons
PROJECT IMPACT		**5,801 ODP tons** (3,475 ODP tons in ongoing projects, totaling 9,276 ODP tons)
PROJECT DURATION		Phase-out in 2007
REQUESTED GRANT		**US$ 42,568,640**
COST-EFFECTIVENESS		**7.34 US$/Kg ODP**
STATUS OF COUNTERPART FUNDING		Letter from the Government
PROJECT MONITORING MILESTONES		Included
NATIONAL COORDINATING BODY		Prozon/ Ministry of Environment

The National CFC Phase-out Plan will phase-out the remaining consumption of 9,276 ODP tons of Annex A, Group I CFCs, over the period of 2002–2006. To achieve this target, a series of investment, non-investment, technical assistance, and capacity building activities will have to be carried out. The National CFC Phase-out Plan will enable the Brazilian Government to phase-out CFC consumption by 01 January 2007.

Considering this multi-faceted approach it is crucial that flexibility is given to the Brazilian Government to be able to adapt or modify its strategies during implementation of this plan as needs arise. Due to the complex and dynamic nature of SMEs, some proposed strategies or approaches to deal with the CFC phase-out in this sector should be able to evolve over time. This is to ensure that the agreed phase-out target will be met.

The Brazilian Government is requesting financial support of US$ **42,568,640** from the Multilateral Fund to cover part of the costs to Brazil of this CFC phase-out plan. The funding is requested in annual allocations starting in 2002 and over the five years 2002 - 2006. Details of the breakdown of the requested funding are provided in the following chapters of this project document.

With 3,475 ODP tons of CFCs to be phased out from ongoing projects that have already been approved and funded by the MLF, this proposed funding request will phase out an additional 5,801 ODP tons of Annex A CFCs for a total phase-out of 9,276 ODP tons. Therefore, the overall cost-effectiveness of this National CFC Phase-out Plan is 7.34 US$/Kg ODP.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS
The approval of this project will result in the elimination of CFCs consumption in Brazil and will allow the country to meet its Montreal Protocol obligations.

BRAZIL

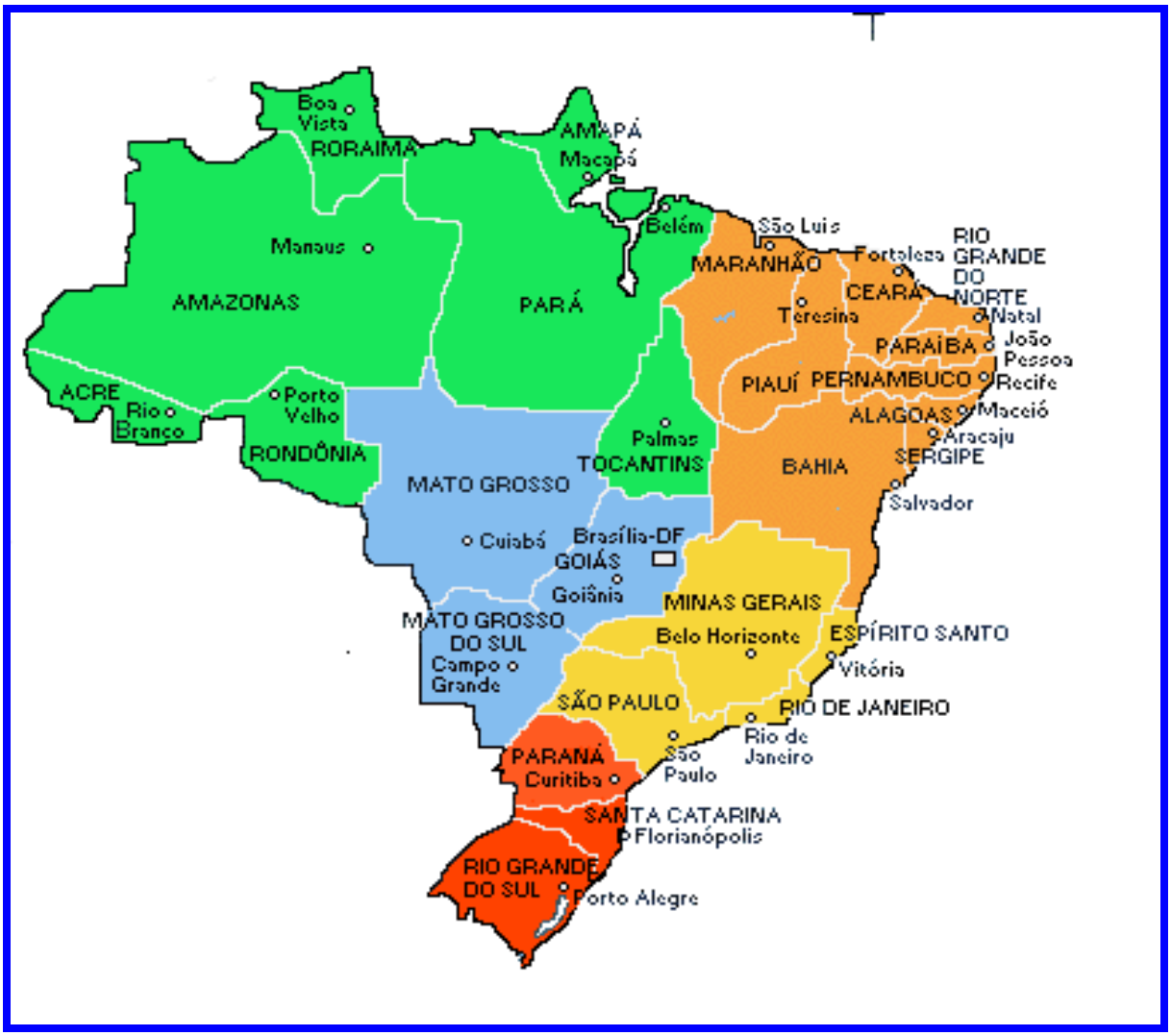
National CFC Phase-out Plan

Jointly prepared by PROZON, the United Nations Development Programme (Lead Implementing Agency), and GTZ (Servicing Technicians and Customs Training Projects)

PROZON is the Brazilian Government National Coordinating Committee for all activities related to Ozone Layer Protection and it is comprised of representatives of the following Ministries:
Ministry of Environment - MMA
Ministry of Development, Industry, and External Trade - MDIC
Ministry of External Relations- MRE
Ministry of Science and Technology – MCT
Ministry of Budget and Management- MOG
Ministry of Health - MS
Ministry of Agriculture and Food Supply- MAA

BRAZIL

States, Major Cities, Geographical Regions, & CFC Consumption



Major Geographical Regions					
	North		***North-East***		***South-East***
	South		***Centre-West***		

Total Annex A CFC Consumption (ODP tons)										
1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
8,111	**8,342**	**9,360**	**9,818**	**10,751**	**10,880**	**10,872**	**9,815**	**9,543**	**11,612**	**9,276**

Population 170 million – Consumption Per Capita in 2000 0.055 Kg

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CHAPTER 1 - INTRODUCTION

1. PROGRAMME OBJECTIVE

The objective of this programme is to assist the Government of Brazil to meet its compliance target for CFC consumption in 2005, and to completely phase out its CFC consumption in 2007, some 3 years ahead of the phase-out schedule stipulated by the Montreal Protocol. A total consumption of 9,276 ODP tons of Annex A, Group I substances in 2000 will be phased-out under this programme, and individual investment projects already approved but not yet completed.

To achieve these objectives, the National CFC Phase-out Programme proposes:

1) To utilize a combination of policies, regulations, and financial support to subsidize the phase-out cost of the industrial sector, the refrigeration and air-conditioning service sectors, and selected refrigeration and air-conditioning end-users sectors;
2) To promote refrigerant recovery/recycling, training, and technical assistance activities including replacement of CFCs during equipment repair, in order to minimize, and eventually eliminate, the import of CFCs.

The programme includes necessary technical assistance components for strengthening the capacity of the industry and concerned agencies to carry out investment, regulations, and public awareness and participation activities. It also proposes an implementation modality, including a monitoring programme, to ensure the successful and effective implementation of this complete CFC phase-out programme.

The monitoring programme is crucial to achieving the overall objective of this National CFC Phase-out Plan, as disbursements will be linked to confirmation of achievement of CFC reduction targets.

2. THE MONTREAL PROTOCOL (MP) OBLIGATIONS

Brazil ratified both the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer in March 1990. It has also subsequently ratified the 1990 London Amendment, and the 1992 Copenhagen Amendment, to the Montreal Protocol. Brazil is classified as a country operating under Article 5 of the Montreal Protocol as its consumption per capita of Annex A, Group I chemicals is less than 0.3 kg ODP per year.

While previously a producer, importer, and exporter of Annex A Group I substances (CFCs), Brazil no longer produces any CFCs, the two CFC production facilities in the country having been closed down in 1994, and 1999, respectively. Total demands for CFCs are now met through imports.

Brazil's average consumption level of Annex A Group I CFCs for the three years 1995 – 1997, the "Baseline Consumption" on which the Montreal Protocol consumption compliance levels are based, was 10,521 ODP tons.

Brazil is now into the compliance phase of the Montreal Protocol and is legally bound to comply with the obligations within the Montreal Protocol and its subsequent Amendments which require Article 5 countries like Brazil to control their annual consumption of Annex A Group I substances (CFCs 11, 12, 113, 114, and 115) as follows:

2000 – 2004 Consumption is limited to the average annual consumption in the three years 1995 – 1997 (the "Baseline Consumption").

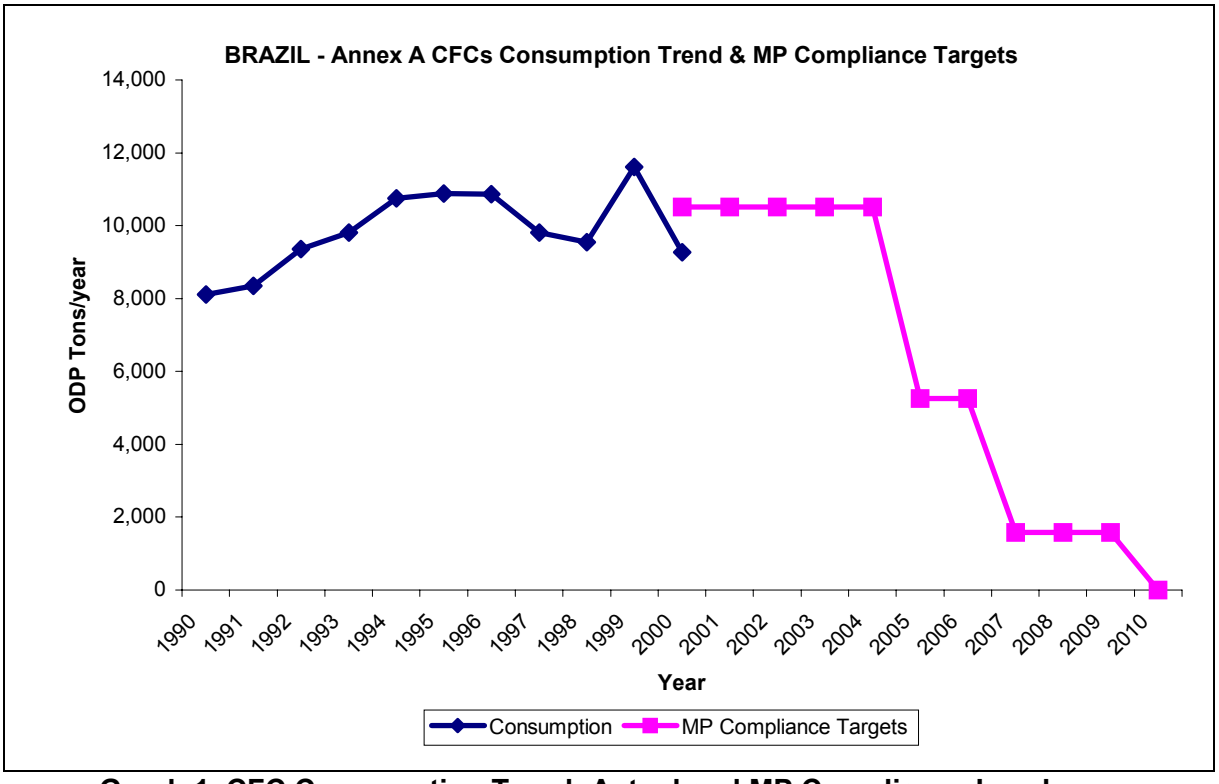
2005 – 2006 Consumption is limited to 50% of the "Baseline Consumption".

2007 – 2010 Consumption is limited to 15% of the "Baseline Consumption".

2010 Zero consumption.

In order to comply with the Montreal Protocol, Brazil must then freeze its annual consumption of Annex A CFCs at 10,521 ODP tons by 2000 and then reduce this to 5,261 ODP tons by 2005 and 1,578 ODP tons in 2007, before final phase-out in 2010.

The following graph illustrates the trend of consumption in ODP tons of Annex A Group I CFCs in Brazil and the consumption control levels for compliance with the Montreal Protocol;



Graph 1. CFC Consumption Trend: Actual and MP Compliance Levels

With consumption of 9,276 ODP tons of Annex A CFCs in 2000, and as illustrated in Graph 1, Brazil is in compliance with the Montreal Protocol "Freeze" control level of 10,521 ODP tons. However, it is only 1,245 ODP tons below the "Freeze" control level, and still some 4,015 ODP tons above the compliance level of 5,261 ODP tons of CFC consumption that it must meet in 2005.

As can be seen in Graph 1, the 2000 consumption of 9,276 ODP tons is very similar to the 1998 consumption of 9,543 ODP tons, and the data over the past 11 years displays no significant trend of declining CFC consumption.

The CFC DEMAND Scenario: The total demand for CFCs is expected to decline during the period 2001 – 2005 as a result of the completion of ongoing MLF investment projects to eliminate CFC consumption in both the foam and refrigeration manufacturing sectors. Based on the projects approved as of 31 March 2002, the ongoing projects should eliminate a total of 3,474 ODP tons of CFCs according to the schedule as indicated in the following Table 1.1.

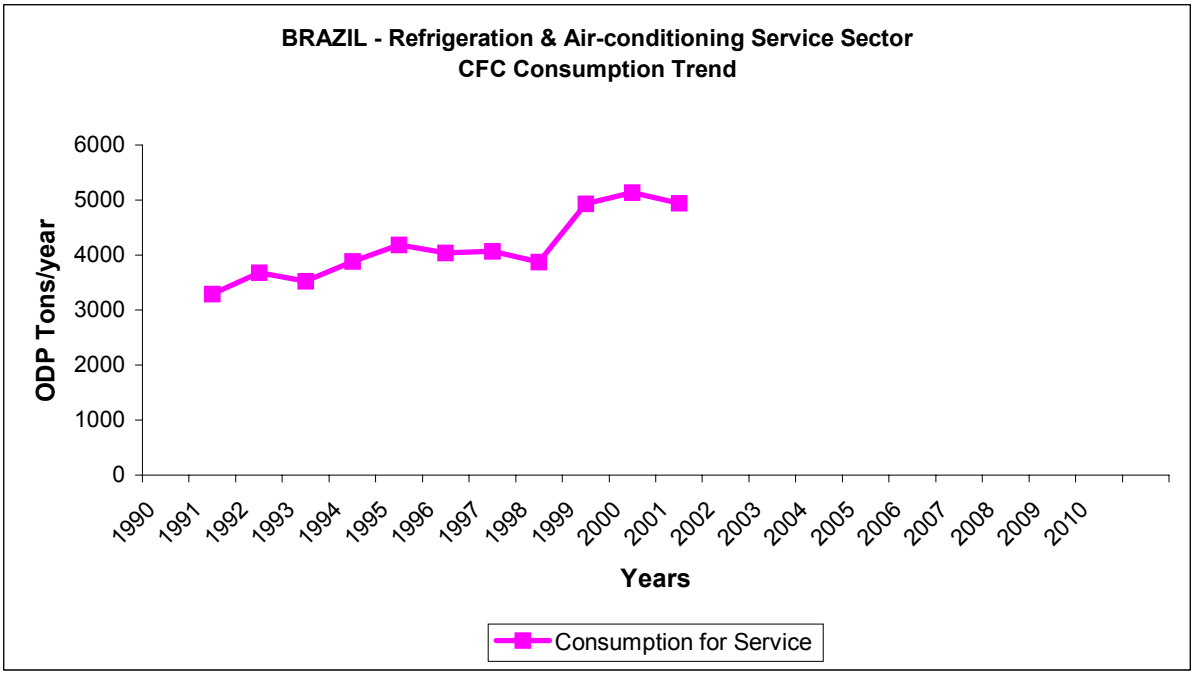
Table 1.1 Annex A CFC Consumption to be eliminated from Ongoing Projects, based on Approved Projects as of 31 March 2002

Annex A CFC Consumption to be phased-out by Ongoing Projects (ODP tons)					
2001	**2002**	**2003**	**2004**	**2005**	**Total**
744.6	**313.2**	**368.5**	**1,787.2**	**260.8**	**3,474.3**

With no other changes, the total consumption of CFCs is then expected to decline to 5,802 ODP tons in 2006 when the full impact of the completion of all current ongoing projects is realised.

More importantly, this suggests that the total demand for CFCs could still be greater than 6,000 ODP tons in 2005, more than the maximum consumption of 5,261 ODP tons permitted by the Montreal Protocol based on a 50% reduction in the "Baseline Consumption" of 10,521 ODP tons, and Brazil would not be in compliance.

Adding to the concerns about non-compliance is the consumption of CFCs in the refrigeration and air-conditioning service sectors. The following Graph 2 based on data provided by PROZON indicates a growing trend of CFC consumption in these service sectors.



Graph 2. Refrigeration & A/C Service Sector: CFC Consumption Trend

The Brazilian economy, like that of many of its neighbouring countries, has gone through a difficult period in the past three years. The problems in Brazil were exacerbated by a National energy crisis in 2001, and the onset of a general global recession. Forecasts of unconstrained demand for CFCs based on GDP growth rates in the 1999 revision of the Brazil Country Programme, and the replacement of CFCs in several manufacturing sectors that has taken place between 1998 and 2000, mean that such forecasts of unconstrained demand have no real value.

It is important however to consider the impact of recession, or an economic downturn, on CFC consumption in a large developing country like Brazil where there is a substantial inventory of CFC based refrigeration and air-conditioning equipment, and a consequential large consumption of CFCs for service and repair activities. Difficult economic conditions lead to reduced investment in new equipment and as a result the lifetimes of existing refrigeration and air-conditioning equipment are forcibly extended.

Aging equipment, coupled with a large number of service mechanics (estimated as circa 60,000) rendering low quality service because they lack training and appropriate tools, is then a recipe for increased consumption of CFC 12 in the refrigeration and air-conditioning service sectors. This is clearly demonstrated in Graph 2 that shows a trend of increasing CFC 12 consumption in the service sectors since 1991. The estimated CFC consumption in the refrigeration and air-conditioning service sectors in 2000 was 4,938 ODP tons, almost all CFC 12.

To date, Brazil has received only very limited assistance to address reduction of the high levels of CFC consumption in the refrigeration and air-conditioning service sectors. An investment project approved in June 1992 for a CFC collection, recycling and conservation programme for household refrigerator maintenance and repair shops in the Sao Paulo Metropolitan Area was cancelled and the funds were returned to the MLF. In July 2001, a pilot training project for

technicians in the refrigeration maintenance sector was approved. This has not yet been implemented, and in itself will have minimal impact on CFC consumption in the service sector. There are no other ongoing projects related to the service sectors that will influence CFC consumption.

With no action to reduce CFC consumption in the refrigeration and air-conditioning service sectors, and given the scenario as described above, then demand can be anticipated to grow further over the next few years. Extrapolation of the consumption data in Graph 2 indicates that consumption in this sector alone could grow to around 5,500 ODP tons in 2005. That would be 240 ODP tons more than the total consumption of 5,261 ODP tons permitted in Brazil in 2005 for compliance with the Montreal Protocol control measures.

It must also be noted that the projected annual reductions in CFC consumption from the completion of ongoing projects are based on the completion dates in the approved project documents. Experience shows that projects are often delayed, particularly in times of economic recession, when the required counterpart funding from the recipient company necessary to complete the project may not be available.

All projections of demand for CFCs then lead to the same conclusion that with no additional intervention by the Government or the Multilateral Fund, Brazil will not meet its Montreal Protocol compliance target for CFC consumption in 2005. Assuming a best-case scenario that demand in the service sector remains constant at the same level as in 2000, and all ongoing investment projects in the manufacturing sector are completed as scheduled the projected consumption over the period 2001 – 2006 would be as in the following Table 1.2.

It should be noted that while the table contains the amounts of CFC that are scheduled to be phased-out in each of the years 2001 – 2005, the full impact of the reduction will not be felt until the following year. The table has therefore been constructed to illustrate this as it is considered a more realistic forecast of future consumption.

Table 1.2 Projected Consumption of Annex A CFCs from 2002 – 2006

	2000	2001	2002	2003	2004	2005	2006
Maximum Consumption permitted by the Montreal Protocol (ODP tons)	10,521	10,521	10,521	10,521	10,521	5,261	5,261
CFC Consumption to be phased-out from completion of ongoing Investment Projects in the Manufacturing Sector (ODP tons)		745	313	368	1,787	261	
Consumption with no additional activity (ODP tons)	9,276		8,531	8,218	7,850	6,063	5,802

The CFC CONSUMPTION Scenario: There is no longer local production of Annex A CFCs and the Government of Brazil introduced import quota legislation for CFC 12 commencing 01 January 2001. Enshrined in CONAMA Resolution No. 267 of 14 September 2000, this defines a maximum baseline level for CFC 12 imports of 8,259 tonnes that must be progressively reduced according to the following schedule:

Table 1.3 Annual Maximum Import Quota for Annex A, Group I CFCs

CFC 12 Maximum Import Quota by Year (tonnes)							
Baseline for CFC 12 Import Quota	Year						
	2001	2002	2003	2004	2005	2006	2007
8,259 tonnes	**7,020**	**5,368**	**3,717**	**2,065**	**1,239**	**413**	**0**

Note: Defined "essential uses" are excluded from this import quota control system.

The same legislation clearly states 01 January 2007 as the phase-out date for all CFC 12 imports except for defined "essential uses".

CONAMA Resolution 267 also addresses the control of CFC 11 imports, again with effect from 01 January 2001, but simply as follows:

"CFC 11 imports will only be permitted to supply the consumption of companies registered at the Brazilian Institute for the Environment and Renewable Natural Resources -IBAMA and that have projects for conversion to CFC-free technologies being implemented or that are about to submit proposals for this purpose for up to 12 months from the date of publication of this Resolution;"

and

"The companies that produce, import, export, trade in or use the controlled substances listed in the Annexes of the Montreal Protocol, or products that contain them, particularly in the services sector, in an annual amount equal to or greater than two hundred kilos, must be registered at IBAMA within a period of twelve months from the date of publication of this Resolution.

The companies mentioned in this article that operate, including all their units, with less than two hundred kilos of controlled substances a year, are not obliged to carry out registration, likewise for the companies, stores and supermarkets that only commercialise products that contain these substances."

There is no import quota quantity specified for CFC 11, nor any CFC 11 phase-out date, Article 3 of this Resolution permits the import of CFC 11 only for consumption by those companies registered with the Brazilian Federal Environmental Agency (IBAMA) with projects to convert to CFC-free technologies that are in the process of implementation or preparation.

There have been some operational difficulties with the licensing system established in relation to imports of CFC 113, CFC 114, or CFC 115 (all imports must be licensed by IBAMA). The actual consumption of CFC 113 and CFC 114 in 2000 was only 29 ODP tons and 17 ODP tons respectively, with no consumption of CFC 115.

The legislation on CFC 11 imports apparently recognises the needs of most of the remaining users of CFC 11 and it provides for an orderly conversion from CFC 11 to non-CFC replacement technologies. In contrast, the legislation on CFC 12 imports results in a very rapid decrease in CFC 12 availability. This despite the fact that there are both ongoing projects, and new projects, in the commercial refrigeration manufacturing sector involving conversion from CFC 12 to non-CFC technologies, and huge consumption of CFC 12 in the refrigeration and air-conditioning service sectors.

In assessing the impact of the above-mentioned legislation on the ability of Brazil to comply with its obligations under the Montreal Protocol on CFC consumption it is necessary to make the following assumptions:

- The imports of CFC 113 and CFC 114 for the years 2001 – 2006 can only be permitted for essential uses and authorised by IBAMA;
- There will be no future imports of CFC 115 as a pure substance, or as R502;
- There will be strict adherence to CONAMA Resolution 267 and the permitted levels of CFC 11 imports will be based solely on the needs of ongoing projects and of enterprises registered in IBAMA;
- That all ongoing projects are completed on schedule;
- That the full impact of projects completed in a particular year on the total levels of CFC consumption will not be realized until the following year;
- There will be strict adherence to CONAMA Resolution 267 and the permitted levels of CFC 12 imports;
- There will be no significant increase in the consumption of CFCs for “essential uses” (MDIs and other pharmaceutical products);
- It is the Brazilian Governments intention to completely phase-out CFCs consumption by 01 January 2007;
- There will be no illegal imports of any of the Annex A CFCs;
- MLF assistance will be available, as the impact on the economy cannot be borne by the society

Based on these assumptions, Brazil would easily achieve compliance with both its 2005 and 2007 Montreal Protocol Consumption targets of 5,261 ODP tons, and 1,578 ODP tons, respectively.

It must also be understood that other factors may influence CFC consumption/demand scenarios during the years 2002 – 2006. These include:

a) With any restriction on supply of CFCs through import quotas, there will be significantly reduced availability of CFCs in the market and this shortfall may be filled by illegal imports with no actual drop in demand.

b) While the price of CFCs has increased after CONAMA Resolution 267 was enacted, they are still considered cheap relative to zero-ODP substitutes. There may then be a tendency to top-up new HFC 134a systems with CFC 12, especially in the MAC service sector, with a resulting increase in demand for CFC 12.

c) If the economy recovers there may be a significant retirement of existing equipment that is replaced with new equipment. Monitoring and enforcement of the legislation in CONAMA Resolution 267 relating to bans on the use of CFCs in such new equipment is essential, otherwise there will be no drop in demand from the retirement of existing CFC based equipment.

d) If companies that have completed phase-out projects under the MLF encounter difficulties because the market conditions are not favourable for the alternative technologies, they may not totally stop using CFCs.

e) Companies that have ongoing projects may not complete them on schedule. Therefore, the consumption in the manufacturing sector may not decline in line with projections based on project data.

While MLF assistance has been critical to Brazil's efforts to reduce CFC consumption, it is still considered limited as the assistance covered only the manufacturing sectors. The Brazilian Government has also worked strenuously and successfully in the past in reducing CFC consumption by legislative measures and contributing to protection of the stratospheric ozone layer.

For instance, the consumption of CFCs as aerosol propellants has been almost completely phased-out without assistance from the MLF. The Brazilian Government banned CFC consumption in the production of non-medical aerosol products in 1988. The remaining CFC consumption of 74 ODP tons in the aerosol sector in 2000 is for "essential uses", being for the production of metered dose inhalers to treat patients with pulmonary disorders, and other pharmaceutical aerosol products.

Brazil has also reduced its CFC 113 consumption from 488 ODP tons in 1990 to 29 ODP tons in 2000. Only 3 investment projects were approved by the MLF for the CFC 113 solvents sub-sector in Brazil. Two of these involved resources totalling US$ 68,400 to eliminate 3.6 ODP tons of CFC 113. The third project involved the phase-out of 2.0 ODP tons of CFC 113 used in the cleaning of medical parts and 14 ODP tons of CFC 12 used in the sterilisation of medical parts. This project was subsequently cancelled, as the recipient enterprise was unable to proceed because the approved funding was insufficient and it had no access to supplementary funds. Without considering growth, Brazil ended up bearing the major share of the cost associated with the reductions in consumption in the CFC 113 solvents sub-sector that have been estimated as US$ 6.0 million. The investment projects required to achieve the reduction in CFC 113 consumption were funded by the National industry as a result of market forces and the need to maintain competitiveness, and also the need to comply with National legislation that initially set 01 January 1997 as the phase-out date for this sector (although this was later amended to 01 January 1999).

While this document is a National CFC Phase-out Plan that deals only with CFCs, it is important to mention that by legislative action, and only very minor assistance from the MLF, Brazil succeeded to phase-out the consumption of TCA in 2000 from a level of over 9,000 tons in 1990. The cost of this TCA phase-out was borne by the private sector and Brazil society in general.

The following Table 1.4 summarises the MLF funding approved to date by sector, excluding projects that were approved but cancelled, not completed.

Table 1.4 Summary of MLF Approved Projects by Sector (Excl. Cancelled Projects)

SECTOR	Total ODP tons	CFC 11 ODP tons	CFC 12 ODP tons	R502 ODP tons	CFC 113 ODP tons	Allocated Funds Excl. Support Costs US$
Total PU Foam Sector	4,167.7	4,159.7	8.0	0	0	26,149,807
Total Polystyrene/Polyethylene Foam	43.5	0	43.5	0	0	314,300
Total Domestic Refrigeration	1,636.2	1,002.4	633.8	0	0	7,831,702
Total Commercial Refrigeration	753.6	536.1	213.7	3.8	0	9,171,065
Total CFC 113 & CFC 113/TCA Solvent	3.6	0	0	0	3.6	68,400
TOTALS	**6,604.6**	**5,698.2**	**899.0**	**3.8**	**3.6**	**43,535,274**
New Foam Projects March 2002	**645.1**	**645.1**	**0**	**0**	**0**	**3,188,292**
GRAND TOTAL	**7,249.7**	**6,343.3**	**899.0**	**3.8**	**3.6**	**46,723,566**

Source: MLF Inventory of Approved Projects – Projects Cancelled

Based on the recent EXCOM Decision 35/57, further MLF funding is predicated on a commitment by Brazil to achieve sustainable permanent aggregate reductions in CFC consumption and production. Having selected Option 2 of Decision 35/57 for determining the starting point for implementation of it's national aggregate consumption (Reported 2000 CFC consumption data minus projects approved but not yet implemented as of December 2000), the remaining CFC consumption eligible for funding under Brazil's National CFC Phase-out Project is 6,446 ODP tons. (See **Annex 1**.)

Subsequent to this, projects to eliminate a further 645.1 ODP tons of CFC 11 consumption in the foam sector in Brazil were approved at the 36th EXCOM Meeting in March 2002. After adjustment for these projects, the remaining CFC consumption eligible for funding under Brazil's National CFC Phase-out Project is then 5,801 ODP tons. (See also **Annex 1**.)

The following Table 1.5 provides an estimate of the breakdown of the remaining ODP tons of CFC consumption by sector and sub-sector, and according data by substance reported based on information obtained from National industry sources in 2001:

Table 1.5 Remaining CFC Consumption Eligible for Funding (ODP tons) - Manufacturing & Service Sectors following EXCOM Methodology & using Option 2 Selected

Sector	Sub-sector	CFC 11	CFC 12	CFC 113	CFC 114	Total
Refrigeration & Air-conditioning Manufacturing	Commercial Refrigeration	70	72	0	0	142
	Transport Refrigeration	0	0	0	0	0
	Domestic Refrigeration	0	0	0	0	0
	Industrial Refrigeration & Central Air-conditioning	0	0	0	0	0
	Mobile Air-conditioning	0	0	0	0	0
Sub-total		**70**	**72**	**0**	**0**	**142**
Refrigeration & Air-conditioning Service	Commercial Refrigeration	0	3,297	0	0	3,297
	Domestic Refrigeration	0	900	0	0	900
	Industrial Refrigeration & Central Air-conditioning	28	60	0	0	88
	Mobile Air-conditioning	0	660	0	0	660
Sub-total		**28**	**4,917**	**0**	**0**	**4,945**
Foam	All Sub-sectors	74	537	0	0	611
Sub-total		**74**	**537**	**0**	**0**	**611**
Aerosols, Sterilants		**17**	**40**	**0**	**17**	**74**
Solvents		**0**	**0**	**29**	**0**	**29**
Process Agents		**0**	**0**	**0**	**0**	**0**
TOTAL		**189**	**5,559**	**29**	**17**	**5,801**

Brazil is willing to make a firm commitment to eliminate this National aggregate CFC consumption to a specific time schedule that will ensure compliance with the Montreal Protocol, but the economic impact on all Brazilian stakeholders has also to be taken into account. Immediate, and substantial, financial assistance from the MLF is therefore necessary given the magnitude of the remaining CFC demand, and considering the size of the country and the wide geographic distribution of consumption, the circa. 60,000 refrigeration technicians involved in the service sector, and the huge and varied inventory of existing CFC based equipment. Brazil must also have the flexibility to allocate funds to sectors/sub-sectors as per the needs of the country to comply, especially taking into consideration that the mechanism approved to determine the remaining fundable consumption does not necessarily take into consideration the real needs of the country.

Presently, the "Brazilian National CFC phase-out plan" is effectively the Brazilian Government legislation in the form of CONAMA Resolution 267 of 14 September 2000. While there are some loopholes in this legislation this is considered to be due to faults in drafting the legislation rather than any lack of intent to regulate CFC uses and consumption, and it is the stated intention of the Brazilian Government to phase-out all but "essential uses" of Annex A CFCs by 01 January 2007 ***subject to receipt of the necessary financial assistance from the MLF and on time to address legislation needs***.

This National CFC Phase-out Project Proposal therefore employs strategies for the phase-out of the remaining consumption of all Annex A CFCs, in all sectors, based on the Brazilian

Governments target of 01 January 2007, so as to minimize the financial impact of this ambitious objective on the country at both the industrial and consumer levels. The strategies employed involve investment and non-investment activities, including public awareness, as well as a combination of policy and regulatory support through revision of the existing legislation.

This National CFC Phase-out Project Proposal therefore proposes a review of the current legislation as embodied in CONAMA Resolution 267 to provide greater time and flexibility to both manufacturing enterprises and end-users to convert to non-CFC technologies, while at the same time ensuring compliance with the Montreal Protocol CFC Consumption Compliance target in 2005, and the Brazilian Government target of CFC phase-out on 01 January 2007.

Instead of the traditional approach used previously in Brazil, where enterprises were identified and individual projects or group projects were prepared for an enterprise, or group of enterprises. This National CFC Phase-out Project Proposal requires enterprises to be proactive and apply for funds based on rules and guidelines established as part of this programme, consistent with MLF funding principles.

To attain proactive participation from the industry, this National CFC Phase-out Proposal proposes to utilise various incentive structures, including financial and regulatory incentives. These incentive structures are designed with the aim of ensuring permanent and sustainable reductions in CFC consumption, compliance with the 2005 Montreal Protocol CFC consumption target, and CFC phase-out by 01 January 2007 as planned by the Brazilian Government. In addition, public awareness activities are also built into this National CFC Phase-out Project Proposal to ensure that both the industry and end-users are fully informed about plans to first reduce, and then phase-out, CFC consumption in Brazil, the short-term and long-term implications of the global CFC phase out efforts, and the possibility for obtaining financial assistance to cover part of the CFC phase-out costs.

It must also be noted that any measures to restrict the supply of CFCs simply by reductions in import quotas without assistance to reduce the demand in the service sector will have the following unacceptable consequences for Brazilian stakeholders:

a) CFCs will be hoarded and the availability of CFCs in the market will be significantly less than the amount permitted by the import quotas.
b) CFC prices will rise accordingly and by significant margins.
c) End-users will have to retire and replace equipment before its anticipated useful lifetime.
d) There will be consequential losses resulting from spoilage of perishable refrigerated goods when equipment cannot be rapidly repaired due to non-availability of CFCs.
e) A black market in CFCs can be anticipated fuelled by illegal imports of CFCs.

Therefore actions are required immediately to address the growing consumption of CFCs in the refrigeration and air-conditioning service sectors, including measures to prevent back-conversion from CFC-free technology to CFCs during service operations. Some form of monitoring must also be considered to ensure that those enterprises in the manufacturing sector that have already converted to non-ODS technology do not revert to CFCs.

Although the remaining consumption of CFCs in the aerosol sector is for “essential” uses, there is a need to address ways of eliminating this 74 ODP tons of CFC consumption.

While in 1994 the solvents sector was the largest ODS consumption sector in Brazil, the reported consumption in 2000 has fallen to just some 29 ODP tons of CFC 113 (as already

mentioned TCA consumption was phased-out in 2000). The remaining consumers need to be identified, and options to convert to CFC-free technologies should be evaluated.

The Brazilian Government policy is to continue its proactive measures to assist remaining CFC-consuming enterprises to convert to non-ODS technology and to provide technical assistance and promote awareness so that the negative economic impacts of CFC phase-out are minimised. To avoid market distortion, the Government will strengthen its monitoring and enforce existing legislation on the use of CFCs in all parts of the manufacturing sub-sectors as soon as possible. It will also introduce and adjust as needed, the legislation covering CFC consumption in the refrigeration and air-conditioning service sectors as soon as feasible following the completion of training programmes and the supply of equipment to service technicians.

To achieve significant and sustainable reductions in CFC consumption in the refrigeration and air-conditioning service sector, a series of investment and non-investment activities, which are necessary to change the behaviour of end-users and service technicians, will have to be implemented starting as soon as possible. The size of the country, the huge inventory of existing CFC based equipment, and the number of service technicians involved, means that actions will have to be implemented regionally. It is also recognized that these types of activities require a long lead time before substantial reduction of CFCs can be achieved.

This National CFC Phase-out Project Proposal sets out the steps needed in order that Brazil can meet these objectives.

3. PROJECT SUMMARY

The National CFC Phase-out Plan will phase-out the remaining consumption of 9,276 ODP tons of Annex A, Group I CFCs, over the period of 2002–2006. To achieve this target, a series of investment, non-investment, technical assistance, and capacity building activities will have to be carried out. The National CFC Phase-out Plan will enable the Brazilian Government to phase-out CFC consumption by 01 January 2007.

Considering this multi-faceted approach it is crucial that flexibility is given to the Brazilian Government to be able to adapt or modify its strategies during implementation of this plan as needs arise. Due to the complex and dynamic nature of SMEs, some proposed strategies or approaches to deal with the CFC phase-out in this sector should be able to evolve over time. This is to ensure that the agreed phase-out target will be met.

The Brazilian Government is requesting financial support of US$ **42,568,640** from the Multilateral Fund to cover part of the costs to Brazil of this CFC phase-out plan. The funding is requested in annual allocations starting in 2002 and over the five years 2002 - 2006. Details of the breakdown of the requested funding are provided in the following chapters of this project document.

With 3,475 ODP tons of CFCs to be phased out from ongoing projects that have already been approved and funded by the MLF, this proposed funding request will phase out an additional 5,801 ODP tons of Annex A CFCs for a total phase-out of 9,276 ODP tons. Therefore, the overall cost-effectiveness of this National CFC Phase-out Plan is 7.34 US$/Kg ODP.

CHAPTER 2 - CFC CONSUMPTION AND DISTRIBUTION BY SECTOR

1. SOURCES OF CFC SUPPLY

In previous years Brazil produced, imported, and exported CFCs and other ODS. While carbon tetrachloride CFC 11, CFC 12, CFC 113, and HCFC 22, were all produced locally, there were also imports to meet demand requirements. CFC 114, CFC 115, and R502, were also imported. Exports of CFCs were to neighbouring South American countries, principally Argentina. CFC users sourced imports from both North America and Europe, and these involved imports by commercial agents, as well as direct imports.

The CFC/HCFC production facilities of Hoechst do Brasil Quimica e Farmaceutica S.A. ceased operation in 1994, while those of Du Pont do Brasil S.A. were closed in August 1999.

The principal commercial agent importers of CFCs were Du Pont do Brasil S.A., Atofina Brasil Quimica Ltda., Frijelar Moto Refrigeracao Ltda., Dow Quimica, Progen Commercial Ltda., Spring Carrier S.A., and Refrigeracao Dufrio Com. Imp. Ltda., while some users imported their requirements directly. The import of both CFC 11 and 12 is now controlled under a licence system (Sistema de Comercio Externo-SISCOMEX) according to CONAMA Resolution No. 267. The maximum permitted imports of CFC 12 by importing/producing companies are based on the quantities imported/produced in 1999 or the average of imported/produced in 1995/1997, whichever is higher and they will be gradually reduced to zero by 01 January 2007. Imports of CFC 11 are now permitted only for consumption by companies registered with the Brazilian Federal Environmental Agency (IBAMA) that have projects to convert to CFC-free technologies that are in the process of implementation, or that have presented proposals for such projects. It is the intention of the Government to also eliminate CFC 11 imports by 01 January 2007. A list of the existing importers is included as **Annex 2**.

2. CFC CONSUMPTION BY SECTOR

The CFC consumption in ODP tons as reported to the Ozone Secretariat is shown in Table 2.1. The table also provides the amount of ODS consumption captured by MLF approved investment projects.

Table 2.1 CFC Consumption 1990 – 2000 (ODP Tons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Reported Annex A Group I (CFCs) consumption	8,111	8,342	9,360	9,818	10,751	10,880	10,872	9,815	9,543	11,612	9,276
Captured through MLF approved projects	N/A	N/A	N/A	N/A	373	901	1,531	625	330	878	1,013

Sources: Reports from PROZON to the Ozone Secretariat for 1998, 1999 and 2000; *"Brazil Country Programme for the Phase-out of Ozone Depleting Substances under the Montreal Protocol – Revision March 1999"*

An estimate of the consumption of CFCs by sector, and sub-sector, has been prepared based on the consumption data in ongoing projects, data used for revision of the Brazil Country Programme in 1999, and from new project identification activities, and sub-sector investigations using local industry sources specifically related to preparation of this National CFC Phase-out

Project. This estimate of CFC consumption by sector, and sub-sector is summarized in Table 2.2. Consumption in this case is based on the Montreal Protocol definition of "Consumption = Production + Imports – Exports". There was no local production of CFCs in Brazil in 2000.

Table 2.2 Estimate of CFC Consumption by Sector (ODP tons) - 2000

CFC	Sector Consumption	ODP Tons by Sector	ODP Tons Total
CFC 11	Import		3,571
	Export		10
	Consumption		**3,561**
	Aerosols	17	
	Foam	3,281	
	Refrigeration (Manufacturing)	235	
	Refrigeration (Servicing)	28	
CFC 12	Import		5,706
	Export		37
	Consumption		**5,669**
	Aerosols	40	
	Refrigeration (Manufacturing)	132	
	Refrigeration (Servicing)	4,257	
	MAC (Manufacturing)	0	
	MAC (Servicing)	660	
	Polystyrene Foam	580	
CFC 113	Import		29
	Export		0
	Consumption		**29**
	Solvent	29	
CFC 114	Import		17
	Exports		0
	Consumption		**17**
	Aerosols	17	
CFC 115	Import		0
	Exports		0
	Consumption		**0**
	Refrigeration (Manufacturing)	0	
	Refrigeration (Servicing)	0	
Total CFC Imports			**9,323**
Total CFC Exports			**47**
Total CFC Consumption			**9,276**

With the ongoing completion of investment projects to eliminate CFC consumption at the larger, more easily identified, enterprises in the manufacturing sector the remaining CFC consumption in the manufacturing sector is now largely by small and medium sized enterprises (SMEs).

While they are believed to exist in significant numbers, they are not easily identifiable. While considerable effort has been put into identifying such enterprises in the foam and commercial refrigeration sectors, it is accepted by PROZON that it is impossible to identify every single SME that is consuming CFCs.

CHAPTER 3 - EXISTING POLICIES AND REGULATIONS

3.1. INSTITUTIONAL FRAMEWORK

Having ratified the Vienna Convention and the Montreal Protocol in 1990, in October 1991 the Inter-ministerial Ozone Working Group (GTO), was created. Coordinated by the Ministry of Industry, Commerce and Tourism (MICT), its members were comprised of representatives of the Ministry of External Relations, Ministry of Industry, Commerce and Tourism, Ministry of Science and Technology, Ministry of Environment and the Secretariat for Planning, Coordination and Budget.

With MLF assistance the first Brazilian Country Programme (CP) was prepared based on 1993 consumption data. The CP was based on the fastest possible phase-out of both ODS production and consumption while taking into consideration the needs of the Brazilian industry, ODS consumers, and the most recent technological and economic data available. At that time, the CP anticipated that all ODS production and consumption could be phased-out by 2001.

In September 1995, the GTO was replaced by PROZON, a new Inter-ministerial Committee comprised of representatives of the following Ministries:

Ministry of Environment (MMA)
Ministry of Industry, Commerce and Tourism (MICT)
Ministry of External Relations (MRE)
Ministry of Science and Technology (MCT)
Ministry of Budget and Management (MOG)
Ministry of Health (MS)
Ministry of Agriculture and Food Supply (MAA)

Coordination of PROZON, initially exercised by MICT, was transferred to the Ministry of Environment in December 1997.

The following government bodies also support Brazil's efforts in complying with its Montreal Protocol obligations:

- The National Space Research Institute (INPE) – linked to MICT
- The Brazilian Federal Environmental Agency (IBAMA) - which maintains a register of all companies that produce, import, export, use or trade in ODS.

The following Industry Associations also supported the Brazilian Government efforts to reduce ODS consumption: ABRAVA, ABRIPUR, ELETROS, ABIQUIM, as well as institutions like SENAI, SEBRAE, and others

The mandate given to PROZON was:

- To coordinate the actions related to the implementation of the Brazilian Country Programme;
- To promote updating of the Country Programme, taking into account scientific and technological developments, economic aspects and in consonance with the Montreal Protocol on Substances that Destroy the Ozone Layer;
- To propose policies and guidelines to guide, harmonize and coordinate the actions related to the protection of the ozone layer;

- To coordinate the allocation of financial resources necessary to carry out the Brazilian Country Programme;
- To coordinate the action of the Multilateral Fund's Implementing Agencies in the implementation of Country Programme;
- To disseminate the Country Programme and promote the participation of society in its implementation.

While significant reductions in ODS consumption were achieved between 1994 and 1998, the rate of ODS reduction was much slower than expected. The first Country Programme considered 5 years to be an adequate time period to phase-out all ODS consumption with appropriate assistance from the MLF, but as a result of MLF policy modifications, new policy decisions, changes in eligibility criteria, etc. it became clear that Brazil could no longer achieve the ODS phase-out targets in the First Country Programme.

A revision of the Brazil Country Programme (CP) was completed in March 1999 using Institutional Strengthening Project funds. In revising the CP, the same strategy of the original version was maintained, that is, analysis of the technical and economic feasibility of implementing the phase-out of ODS. With regard to the strategies for ODS phase-out in Brazil, three main possibilities were evaluated: a delayed one, an accelerated one and a moderate one.

The strategy chosen for Brazil consists of adopting a phase-out that moves the country away from ODS as fast as possible, counting on access to financial assistance from the MLF, with due consideration and timing adjustments given to the unique elements that apply to the Brazilian situation, in such a way as not to lose markets already conquered.

3.2. POLICY FRAMEWORK

Actions to limit the use of ODS were adopted unilaterally by Brazil starting in 1998 when by Government Decree the use of ODS in non-essential aerosols was prohibited, and aerosol products were required to be labelled to indicate that they were CFC-free.

Federal policy activities began in earnest with Legislative Decree No. 91, dated 15 December 1989, when the National Congress approved the texts of the Vienna Convention and the Montreal Protocol. Both were formally ratified in March 1990, and entered into force in June 1990. Decree No. 99,280, issued by the President of Brazil, dated 06 June 1990, promulgated the texts of the Convention and the Protocol, determining that they should be fully implemented and complied with by Brazil. Brazil subsequently ratified the London Amendment (1990) and Copenhagen (1992) Amendments to the Montreal Protocol in 1991, and 1996, respectively.

Policy implementation was based on the sectoral analysis of ODS users in the first Country Programme, and proposals for related economic, technological and regulatory actions, with the latter two receiving most attention.

3.3. COUNTRY PROGRAMMES & GOVERNMENT ACTION PLANS

The Plan of Action presented in the 1994 Country Programme included proposals for establishing policies that would define quota reductions on production and consumption of ODS for all domestic manufacturers. Moreover, it included strategies of gradual limitation or prohibition of ODS imports, as well as proposals for federal/state tax increases on ODS. Other more specific actions included:

- Prohibiting of production, import, export and commercialisation in the domestic market of new products containing ODS;
- Incentives to replace and to discourage ODS use;
- Tax incentives to stimulate consumers to adopt alternative technologies;
- Labelling (seal) for substances that do not harm the ozone layer;
- Establishment of credit lines to stimulate industrial conversion of small and medium sized companies;
- Supplemental regulatory procedures for ODS production and import;
- Programme to train technicians and certify establishments that repair refrigeration equipment;
- Specific awareness programs for small industries and services companies;
- Regulation to limit voluntary emissions and escapes during servicing or operation of equipment with ODS;
- Quality assurance programme for recycled gases and alternative substances.

Analysing these proposals when revising the Country Programme in 1999, some were deemed more effective in practice than others, bearing in mind the respective cost/benefit. Initial implementation of the 1994 Action Plan included the identification and design of industrial conversion projects; creation of an inventory of ODS emissions based on the IBAMA register of producers, importers, exporters, users and traders; and regulation establishing deadlines for bans of various ODS uses in new equipment, in the respective user sectors.

By 1999 the Brazilian Government was studying the following list of possible regulatory actions:

3.3.1. Brazilian Government actions that foster strengthening of the Country Programme through the creation of regulatory instruments and by monitoring implementation of the Country Programme.

- Establishing legislation and standards with the following objectives:
    - To define annual quota of ODS production, in reference to its own production level established by the average of 1995/1996/1997 figures, aiming at meeting the deadlines provided by the Montreal Protocol;
    - To define annual decrease of ODS imports, through quotas;
    - To establish quality standards for alternative substances, recycled gases and converted equipment, as practiced by Article 2 countries;
    - To prohibit voluntary emissions during the operation or servicing of equipment that contains ODS, except for essential use;
    - To ensure the quality of recycled gases.
- Set up Control and Inspection Systems with the following objectives:
    - To establish regulatory actions that allow a period for phase-out of ODS import;
    - To prohibit the manufacture, import, export and domestic commercialisation of new end-products which contain ODS, except for repair parts and components to be used in existing systems and equipment. The dates chosen will be in agreement with the completion of the sectoral phase-outs;

- To avoid the return to ODS in systems that are already ODS-free;
- To verify compliance with the Federal Decree No. 2,783/98.

3.3.2. Actions to stimulate the Brazilian production sector to use substances that do not deplete the ozone layer.

- Creation of economic instruments with the following objectives:
  - To define increasing rates for federal and state taxes applied to ODS;
  - To define investments or financing that encourage the use of ODS replacements and discourage the use of ODS, by the various industrial sectors;
  - To exempt the Multilateral Fund concessions from taxes and tariffs;
  - To encourage the adoption of alternative technologies by consumers;
  - To encourage measures that offer a favourable credit line to companies that are engaged in activities and projects, that supplement, but are not financed by the Multilateral Fund;
  - To stimulate manufacturers of equipment and systems to supply ODS-free products in more favourable conditions than those with ODS.
- Establish Training Programs with the following objectives:
  - To train refrigeration technicians, and issue certification to those engaged in installation and repair of refrigeration equipment, as well as to those involved in recovering and recycling programs.

3.3.3. Actions seeking mobilization and motivation of the public to support implementation of the Country Programme.

- Establishment of a public campaign with the following objectives:
  - To establish a public awareness campaign on the importance of the ozone layer issue and its effects on life in the Planet, particularly on human life, and the current, National and International, Government and industry actions to address the problem, as well as reporting on the overall contribution of the country to the Montreal Protocol;
  - To label substances that are not harmful to the ozone layer. This should be combined with a public awareness program to ensure favouring of ODS-free technologies;
  - To reach out to small and medium size industries and service companies, creating a favourable climate that will allow such a labelling program to have the positive impact of an economic incentive.

Following revision of the Country Programme in 1999, CONAMA Resolution No. 267 of 14 September 2000 was adopted. This addressed the revised ODS phase-out strategy in the Country Programme, and introduced ODS import quota controls.

3.4. CONAMA RESOLUTION No. 267 OF 14 SEPTEMBER 2000

In 2000, CONAMA Resolution No. 267 of 14 September was adopted. This revoked both the earlier CONAMA Resolution No. 13 of 13 December 1995 and CONAMA Resolution No. 229 of 20 August 1997.

Under CONAMA Resolution 267, all controlled substances are also regulated under the License System created by PROZON. CFC 12 and CFC 11 account for over 99% of Annex A and Annex B ODS consumption and the controls on CFC 12 and CFC 11are as follows:

CFC 12 imports will be controlled as follows according to Article 3^0 of CONAMA Resolution 267 " - ***the maximum imports of CFC-12 will undergo gradual reductions in weight, per importing/producing company, according to the schedule contained in paragraphs "a" to "g" of this item, and will be based on the amount of imported/produced CFC-12 in the year of 1999, and it may not exceed the average of imports/production of this substance, per company, for the period 1995-1997:***

a) 15% in the year 2001;
b) 35% in the year 2002;
c) 55% in the year 2003;
d) 75% in the year 2004;
e) 85% in the year 2005;
f) 95% in the year 2006; and
g) 100% in the year 2007;

CFC-12 imports will be banned in 2007;"

It is important to note that the import quotas for CFC 12 allocated to the eligible importers are based on the 1999 level of CFC 12 **imported/produced in 1999** with **no account taken of exports**, but they must not exceed the annual average quantity of CFC 12 **imported/produced** during the three years 1995 – 1997 (**again no account taken of exports**). In 1999 there was still local production of CFCs, and with imminent plant closure there was additional production beyond immediate demand for stock.

The following Table 3.1 illustrates the data on CFC 12 production, imports, exports, and consumption, for the years 1994 – 2000.

Table 3.1. CFC 12 Production, Imports, Exports, & Consumption 1994 - 2000

CFC 12 Production, Imports, & Exports (tonnes)							
Year	***1994***	***1995***	***1996***	***1997***	***1998***	***1999***	***2000***
Production	***7,349***	***7,003***	***5,770***	***5,585***	***5,300***	***7,928***	***0***
Imports	***1,871***	***1,810***	***2,680***	***1,930***	***2,352***	***2,391***	***5,707***
Exports	***2,815***	***2,688***	***2,260***	***1,800***	***1,751***	***2,268***	***38***
Consumption	***6,405***	***6,125***	***6,190***	***5,715***	***5,901***	***8,051***	***5,669***

Brazilian **consumption** in the table is based on production plus imports - exports. A local producer will always have a dominant share of the market, but once local production has

stopped and Brazil has to rely totally on imports to meet demand. Allocated import quotas are based on the levels of CFC 12 **imported/produced by enterprises**, rather than either on **the amount imported**, or **the contribution to consumption** (production + imports – exports).

In respect of CFC 12, CONAMA Resolution No. 267 clearly aims at controlling the import, and hence consumption, of CFC 12 to assist Brazil in meeting its 2005 Montreal Protocol ODS consumption compliance target, before the complete phase-out in 2007 substantially earlier than required under the Montreal Protocol.

While the allocation of import quotas to importers are based on the 1999 levels of import/production, the maximum level of imports permitted by an importer may not exceed the average annual level of CFC 12 imports/production during the three years 1995 – 1997. If the intention is to control imports of CFC 12 in line with the permitted "baseline consumption" (average 1995 – 1997) then the maximum level of imports permitted by an importer should be related to **CFC 12 consumption in that period**.

From the following Table 3.2. it can be seen that the maximum annual level of imports of CFC 12 to which the import quotas may be applied is then 8,259 ODP tons, while the allocation of import licences will be based on the total of 10,319 ODP tons imported/produced in 1999.

Table 3.2. Baseline Level for CFC 12 Imports under CONAMA Resolution No. 267

Substance	Production			Import			Total		
	95	96	97	95	96	97	95	96	97
CFC-12	7003	5770	5585	1810	2680	1930	8813	8450	7515
Average	6,119			2,140			**8,259**		
	1999			1999			1999		
CFC-12	7928			2,391			10,319		

CFC 11 imports will be controlled as follows according to Article 3^0 of CONAMA Resolution 267 " - ***CFC-11 imports will only be permitted to supply the consumption of companies registered at the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) and that have projects for conversion to CFC-free technologies being implemented or that are about to submit proposals for this purpose for up to 12 months from the date of publication of this Resolution***;"

Article 9^0 of CONAMA Resolution 267 also states " - ***The companies that produce, import, export, trade in or use the controlled substances listed in the Annexes of the Montreal Protocol, or products that contain them, particularly in the services sector, in an annual amount equal to or greater than two hundred kilos, must be registered at IBAMA within a period of twelve months from the date of publication of this Resolution.***

§ 1. The companies mentioned in this article that operate, including all their units, with less than two hundred kilos of controlled substances a year, are not obliged to carry out registration, likewise for the companies, stores and supermarkets that only commercialize products that contain these substances."

3.5. OTHER ACTIONS TAKEN BY PROZON TO CONTROL CFC CONSUMPTION

See **Annex 3** for other actions taken by PROZON to control, and reduce, CFC consumption.

CHAPTER 4 - SECTOR BASELINE INFORMATION

1. AEROSOL SECTOR

1.1. NON-MEDICAL PRODUCTS

The consumption of CFC in the production of non-medical aerosol products such as personal hygiene products, hairsprays, perfumes, household products, insecticides, automotive products, industrial products, and paints, etc., was banned in 1988 under Brazilian legislation in 1988, even before Brazil became a Party to the Montreal Protocol.

The aerosol manufacturers concerned were given one year to make the conversion to non-CFC technology and according to the 1994 Brazil Country Programme the conversion was completed in 1989.

Exempted from the 1988 legislation was the use of CFCs in medicines and pharmaceutical formulations for treatments in aerosol form, such as Metered Dose Inhalers (MDIs) and/or assembled in the form of a spray for nasal or oral use, such products being considered as "essential uses".

1.2. MEDICAL PRODUCTS

The Montreal Protocol subsequently adopted a similar definition for the "essential uses" of CFCs in aerosol products, and CONAMA Resolution No. 267 refers to the Montreal Protocol definition. All the remaining CFC consumption in the aerosol sector is then believed to be for the manufacture of aerosol MDIs, predominately bronchodilator products for the treatment of asthma and chronic obstructive pulmonary disease (COPD).

The CFCs used in the manufacture of MDIs are CFC 11, CFC 12, and CFC 114, although not all MDIs use CFC 114.

Annual usage of MDIs in Brazil is around 6.3 million units, with over 98% of these MDIs supplied by three multi-national pharmaceutical companies (Glaxo Smith Kline, Boehringer-Ingleheim and Cheisi). While this would equate to consumption of approximately 150 tonnes of CFCs, only one of these companies (Boehringer-Ingleheim) is currently producing MDIs locally in Brazil. Glaxo Smith Kline and Cheisi are importing their MDI products, primarily from Europe.

It is understood that the small balance of the MDI's are supplied by the Brazilian enterprise Biosintetica who produces approximately 60,000 –100,000 units per year.

Previously, Glaxo Smith Kline was also producing MDI products in Brazil but in 2000 it changed from local production to importing finished product from Europe.

Based on this background, typical MDI formulation data, and data from CFC importers, it can be confidently concluded that the total annual CFC consumption for MDI production in Brazil in 2000, and 2001, was as some 74 ODP tons comprised of individual CFCs as follows:

CFC 11	-	17 ODP tons
CFC 12	-	40 ODP tons
CFC 114	-	17 ODP tons

While the consumption of CFCs for MDI production is then presently less than 1% of the total consumption of Annex A CFCs, Brazil needs to deal with this sector, and to seek eligible assistance from the MLF, taking into account the following:

- The only remaining essential use involving significant quantities of CFC 11 and CFC 12 is in MDIs for the treatment of asthma and chronic obstructive pulmonary disease.
- The only significant production of the high quality CFCs needed for MDI use is in the European Union.
- The Developed Country CFC production phase-out is complete, except for the basic domestic needs of Article 5. Countries, and for agreed "essential uses". There is Governmental pressure on European Union producers to cease supply even for these uses.
- The remaining production of CFCs for MDIs is in the Netherlands and the UK. All production is likely to end in 2003 – 2004, with some stockpiling to meet demand up to 2005.
- The remaining production of CFCs in Article 2 Countries for the basic domestic needs of Article 5. Countries is likely to be very minor after 2003, after which the supply will be from Article 5 Country producers.

The Brazil strategy for the phase-out of CFC consumption in the aerosol sector needs to take account of these factors.

2. SOLVENT SECTOR

In Brazil, CFC consumption in the solvents sector was principally for cleaning purposes in the electronics and precision engineering industries. The most commonly used solvents were CFC 113 and 1,1,1-trichloroethane (TCA), with a very small amount of CTC that was believed to be used in laboratory applications.

Table 4.1. provides data on CFC 113 consumption in the solvents sector:

Table 4.1. Solvent Sector CFC 113 Consumption (ODP tons) 1990 - 2000

BRAZIL – SOLVENT SECTOR CFC 113 CONSUMPTION (ODP tons)										
1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
488	376	256	170	161	94	60	32	37	33	29

As the data shows, there was a decline in CFC 113 consumption in the solvents sector from 1990 until 1997 since when it has levelled off at around 35 ODP tons per year.

Only 3 investment projects were approved by the MLF for the CFC 113 solvents sub-sector in Brazil. Two of these involved resources totalling US$ 68,400 to eliminate 3.6 ODP tons of CFC 113. The third project involved the phase-out of 2.0 ODP tons of CFC 113 used in the cleaning of medical parts and 14 ODP tons of CFC 12 used as in sterilisation of medical parts. This project was cancelled, as the recipient enterprise was unable to proceed because the approved funding was insufficient and it had no access to supplementary funds.

A single project in the "Combined CFC 113 and TCA" sector was approved to phase-out the use of 7.8 ODP tons of CFC 113 and 4.8 ODP tons of TCA in vapour degreasers to clean

parts at an aircraft manufacturer. The sum approved was US$ 308,215 (excluding Agency Support Costs), and this project was cancelled, not completed.

It is not clear whether the ongoing consumption of CFC 113 represents consumption in full, or part, by the enterprises whose projects were cancelled.

Without considering growth, Brazil ended up bearing the major share of the cost associated with the reductions in consumption in the CFC 113 solvents sub-sector. The investment projects required to achieve the reduction in CFC 113 consumption were funded by the National industry as a result of market forces and the need to maintain competitiveness, and also the need to comply with National legislation that finally set 1999 as the phase-out date for this sector.

The reasons for the ongoing use of CFC 113 are not clear, and the identities of the remaining users, and the applications, need to be established. CONAMA Resolution 267 permits CFC imports for “essential uses”, and such essential uses include “as an agent in chemical and analytical processes and as a reagent in scientific research” (such as laboratory uses).

There are commercially available alternative technologies to replace CFC 113 and the remaining users need to be made aware of the replacement technologies, and the National legislation.

3. FOAM SECTOR

The Foam Sector is composed of four sub sectors: rigid, flexible, molded/integral skin and polystyrene foams. The foam industry (including domestic and commercial refrigeration) consumed 4,096 ODP tons (44.2%) of the total CFC consumption of 9,276 ODP tons in Brazil in 2000, and is the second largest CFC consuming sector in Brazil.

Furniture and bedding companies produce flexible slabstock and molded foams for cushions, mattresses, pillows, etc. In refrigeration, foams are used in refrigerators, freezers, refrigerated display cabinets/counters, trucks, industrial cold storage facilities, etc. The automotive industry includes flexible molded and integral skin foams for seats, backs, steering wheels, headrests, arm rests, carpet backing, sound insulation and many other applications. The building and construction sector includes rigid blocks, panels, thermally insulated roof panels, as well as the manufacturers and users of spray and/or injection processes. Other miscellaneous applications include bicycle and motorcycle seats, lunch pails, thermos flasks, surfboards, ornamentals, and packaging.

A 1999 survey identified 605 ODS-consuming enterprises in the foam sector**.**

3.1 Consumption Scenario in the Foam Sector

In spite of MLF assistance to a large number of enterprises in the foam sector, CFC consumption in 2000 remained at 3,861 ODP tons, comprised of 3,281 ODP tons of CFC 11 and 580 ODP tons of CFC 12. 3,516 ODP tons (98.7%) of the total of 3,561 ODP tons of CFC 11 consumption in 2000 was for the manufacture of PU foam in the foam and refrigeration sectors.

The growth of the rigid, flexible, molded/integral skin and polystyrene foam sub sectors reflects the economic recovery and the restrained demand for housing. The rigid foam sector has the largest share, with uses include building and construction (roofing tiles, panels and sprayfoam), as well as in the refrigeration sector.

To date, virtually all of the phase-out efforts have been concentrated on the large and medium enterprises, with individual projects prepared and implemented. In 1999, several group projects were prepared addressing 85 smaller enterprises through three systems houses. The most recently approved, with 50 enterprises, was approved in July 2000 (Plastquim). There are still many identified small and medium enterprises to be addressed through a combination of system house projects and other innovative phase-out plans targeting occasional buyers and distributors, assuring a complete phase-out in Brazil.

Article 3^0 of the CONAMA Resolution 267 allows the import of CFC 11 from 01 January 2001 only for consumption by companies registered with the Brazilian Federal Environmental Agency (IBAMA) that have projects to convert to CFC-free technologies that are in the process of implementation, or preparation. These companies must follow the phase-out programme according to the assistance approved under the MLF, and the phase-out date must not go beyond the end of 2006.

The new legislation will be monitored and enforced in harmony with the MLF phase-out efforts to assure that newly identified and approved projects as well as ongoing projects in the foam sector are allowed to proceed and be completed according to the guidelines of the MLF and implementation milestones approved.

3.2 Status of Already Approved Foam Projects

As of 31 March 2002, 144 projects in the foam sector have received MLF assistance.

As of 31 March 2002, and based on the inventory of approved projects as of 31 December 2000, **55** projects have been officially certified as complete and these have resulted in elimination of **1,605.6** ODP tons of CFCs (Table 4.2). Alternative technologies employed by these projects include methylene chloride (MeCl), liquid carbon dioxide (LCD), low index additive (LIA) for slab-stock, and HCFC-141b or water for all other applications.

Table 4.2 Status of MLF Approved Project in Foam Sector

Status of MLF Approved Projects	ODP Phase out by projects (Tonnes)			
	No. of Projects	CFC-11	CFC-12	Total
Completed Projects	55	1,597.6	8.0	1,605.6
On-going Projects	74	2,562.1	43.5	2,605.6
New Projects	15	645.1	0	645.1
Total	**144**	**4,804.8**	**51.5**	**4,856.3**
Cancelled Projects	4	43.5 *	135	178.5 *

* Impact of Cancelled TERMOLAR project BRA/FOAM/18/INV/34 not included.

The 74 on-going projects and the 15 new projects approved at the 36th ExCom Meeting in March 2002 should eliminate a total of 3,250.7 ODP tons of CFCs according to the schedule indicated in Table 4.3. It should be noted that while the table contains the amounts of CFCs that are scheduled to be phased-out in each of the years 2001 – 2005, the full impact of the reductions on consumption would not be felt until the following year. Table 4.4 shows the breakdown of the ODP tons to be phased out according to sub-sector.

Table 4.3 CFCs to be phased out by ongoing MLF approved projects in foam sector

CFCs to be phased out by ongoing projects in the foam sector (ODP tons)							
2001	2002	2003	2004	2005	2006	2007	Total
685.6	257.4	304.0	1742.9	260.8	0	0	3250.7

Table 4.4 ODP to be phased out by ongoing MLF approved projects in foam sector, according to sub-sector

FOAM SUB-SECTOR	ODP tons to be Phased-out		
	Total	CFC-11	CFC-12
RIGID FOAM	1,736.4	1,736.4	0
FLEXIBLE MOLDED	101.8	101.8	0
FLEXIBLE POLYURETHANE FOAM	23.0	23.0	0
INTEGRAL SKIN	638.3	638.3	0
MULTIPLE SUB-SECTORS	707.7	707.7	0
POLYSTYRENE/POLYETHYLENE	43.5	0	43.5
TOTAL	**3,250.7**	**3,207.2**	**43.5**

Sectoral Phase-out Plan

Preliminary identification has been completed of the remaining enterprises producing foam in the foam sector in Brazil. The breakdown of these remaining enterprises by sub-sector is as shown in the table below. Very small enterprises are included under group projects headed by systems houses, with each systems house shown as one enterprise. It should be noted that under the rigid foam category is included a group of enterprises more properly defined as Transport Refrigeration, but for purposes of projects are classified as rigid foam.

Table 4.5 Remaining Identified Enterprises Producing Foam using CFCs (ODP tons)

Sub-Sector	No. of enterprises	Identified CFC 11 consumption	Identified CFC 12 consumption	Remaining CFC eligible for funding
Rigid Polyurethane Foam	32	620	0	10
Flexible Molded/Integral Skin polyurethane foam	3	25	0	10
Flexible Polyurethane Foam	22	790	0	34
Polyethylene/Polystyrene	2	0	537	537
Multiple Sub-sectors	5	310	0	20
TOTALS	**64**	**1745**	**537**	**611**

An Action Plan has been developed to ensure that all eligible enterprises have the opportunity to participate in a project. The first step involves verification of eligibility

according to MLF criteria, including foundation date of the enterprise, IBAMA registration and verification of CFC consumption with invoices. Enterprises with consumption greater than 10t/y CFC-11 can receive an individual investment project, while enterprises with consumption between 1 and 10 t/y are targeted for investment projects through systems houses. For enterprises with CFC-11 consumption under 1 t/y, technical assistance projects are proposed.

Creativity and resourcefulness will be required in order to provide meaningful assistance to the many enterprises remaining to receive assistance under this program. Most projects in the foam sector can be completed within 2 years (although more complicated projects have required up to 3 years). Initiation of implementation of these projects by the end of 2003 would ensure full phase-out by the targeted date of end-2006.

4. REFRIGERATION SECTOR

4.1 REFRIGERATION MANUFACTURING SUB-SECTORS

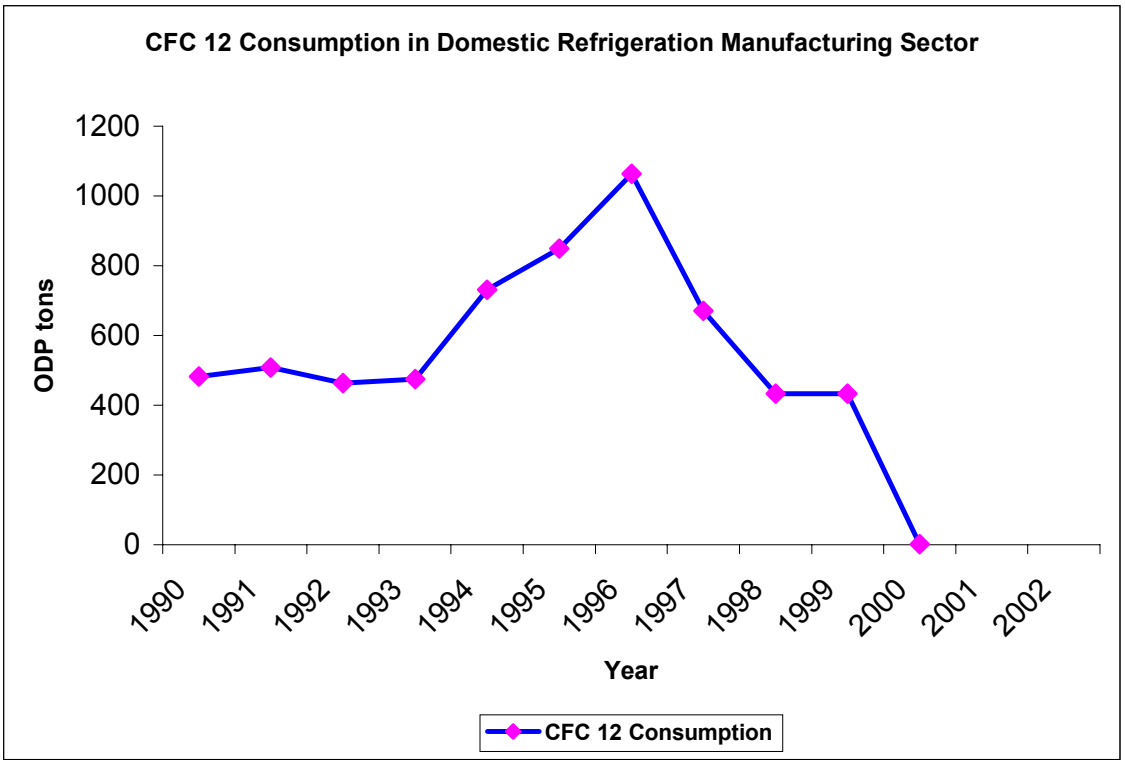
4.1.1. Domestic Refrigeration - Manufacturing

This sector involves the manufacture of household refrigerators and freezers, and historically it involved the consumption of CFC 12 as the refrigerant, and CFC 11 as the blowing agent in the production of the insulation foam for the refrigerator and freezer cabinets and doors.

In 1993 there were 6 enterprises engaged in the manufacture of domestic refrigerators and freezers. Production capacity was around 4 million units, whilst sales were estimated at only 2.75 million units due to the state of the national economy. By 1997 production volume had risen to almost 5 million units, while production capacity increased to an estimated 6.0 million units per annum. Production in 2000 was 3.8 million units.

In the early 1990's, two large companies controlled by multinational capital were responsible for almost 90% of production, with four smaller companies, one with foreign capital, making up the balance. In the late 1990's two new production facilities based on CFC-free technology were installed, both again involving multinational capital. This is a reflection of globalisation and the consolidation of the production of domestic refrigerators and freezers between a smaller number of multinational enterprises in strategic markets. Representatives of major European and US multinational companies now dominate the Brazilian domestic refrigeration market.

CFC consumption data from PROZON has tended to include the CFC 11 consumption in the production of insulation foam in the refrigeration sector as consumption in the "foam sector". Therefore the CFC consumption trend data for the domestic refrigeration manufacturing sector relates only to CFC 12 consumption. Graph 3 illustrates this data:



Graph 3. CFC 12 Consumption Trend – Domestic Refrigeration Manufacturing Sector

The MLF Secretariat Inventory of Approved Projects indicates that 5 investment projects for Brazil were classified as "Domestic Refrigeration" and these were to eliminate 1,636.2 ODP tons of CFC at a total cost of US$ 7,831,702. This represents a cost-effectiveness of only 4.79 US$/Kg compared with the domestic refrigeration investment sector threshold of 13.76 US$/Kg.

All the manufacturers of domestic refrigerators and freezers in Brazil have been identified and MLF assistance for projects for conversion to non-CFC technology was obtained for those eligible for such assistance. Only two projects remain ongoing and these are to eliminate a total of 30.4 ODP tons of ODS comprised of 28.7 ODP tons of CFC 11 and 1.7 ODP tons of CFC 12.

Table 4.6 Status of MLF Approved Projects - Domestic Refrigeration Sector

Status of MLF Approved Projects	Number of Projects	ODP Tons to be phased-out by projects
Completed Projects	3	1,605.8
On-going Projects	2	30.4
Total	5	1,636.2

Note: The 30.4 ODP tons to be phased out by the 2 ongoing projects takes into account that the "Refrigeration Part" of the METALURGICA VENAN project (BRA/REF/28/INV/132) was formally completed in 2000.

Table 4.7 Estimate of Timing for Additional ODP tons of CFCs to be phased out by ongoing projects

Estimate of Trend in CFC Phase-out from Ongoing Projects (ODP tons)					
2001	2002	2003	2004	2005	Total
0	27.9	2.5	0	0	30.4

The estimated population of domestic refrigerators and freezers in the Brazilian market is now some 62 million units, of which some 55 million contain CFC 12 refrigerant representing a 'bank" of around 8,250 ODP tons of CFC 12.

4.1.2. Commercial & Transport Refrigeration – Manufacturing & Installation

The commercial refrigeration sector covers the food chain in all its aspects from the point of production, through the transport and storage stages, to storage at the final point of sale and/or consumption.

A wide range of equipment is involved in refrigerated storage applications that can be divided into three broad categories:

a) Unitary or self-contained equipment where all of the components including the condenser unit are incorporated into the equipment, and the equipment is charged with refrigerant by the manufacturer and sold as an operating unit. Equipment in this category includes refrigerated display cases, food storage equipment (refrigerators and freezers), refrigerated vending machines, drinking water coolers, ice cream machines, etc. The refrigerants involved still include CFC 12, R502, and HCFC 22, and more recently HFC 134a and R404A, R507, etc., according to the required duty of the equipment.

b) Non-unitary central systems where the compressors are located in a separate machine room. These systems are mostly used in supermarkets and the refrigerant fluid passes to the evaporators located in the refrigerated display cases within the supermarket, the vapour returning to the machine room for compression, and subsequent condensation and return again to the evaporators. The most commonly used refrigerant today is HCFC 22, although both CFC 12 and HFC 134a based systems may also be found. Refrigerant is charged on site.

c) Split, or remote, systems, where the condensing units (compressor and condenser) are separated from the cooling equipment (evaporator) in applications such as small food preparation areas, cold rooms, etc. Again the refrigerants involved still include CFC 12, R502, and HCFC 22, and more recently HFC 134a and R404A, R507, etc., according to the required duty of the equipment. Refrigerant is charged on site.

There are also several types of refrigerated transport equipment found in refrigerated road transport (trailer units, trucks, etc.), refrigerated ships containers (reefer boxes), refrigerated rail cars, and fishing boats:.

a) Refrigerated trailer units and the larger refrigerated truck units are usually based on independently electrically driven unitary refrigeration systems, while the smaller refrigerated trucks have systems driven by the truck engine. The refrigeration effect

is usually achieved by cold air, although there are other systems involving evaporators, and even some that use eutectic plates. Again the refrigerants involved still include CFC 12, R502, and HCFC 22, and more recently HFC 134a and R404A, R507, etc., according to the required duty of the equipment. Refrigerant charges range from around 10Kg for the trailers to 6 Kg for the larger trucks, and 3 Kg for the smaller trucks.

b) Refrigerated ships containers come in two types, those with an integral refrigeration system that is usually electrically powered, and insulated containers that require an external source of refrigeration, either by a clip-on refrigeration unit, or refrigerated air from a large air handling unit. Historically, refrigerated containers with an integral refrigeration system used CFC 12 as the refrigerant and the charge was circa 5 Kg. Refrigerated ships containers are normally part of a fleet operated by multinational companies and hence new container production has been mostly based on HFC 134a since the early 1990's, with some based on HCFC 22 for the Japanese market where there is a demand for lower cargo temperatures.

c) The use of refrigerated rail cars is concentrated in the CIS (former Soviet Union) and the USA. The refrigerant employed was CFC 12 with a charge weight of around 15 Kg. Production of new refrigerated rail cars is believed to be based on refrigerant HCFC 22.

d) Refrigerated storage on fishing boats is custom designed and is usually based on HCFC 22. Many fishing boats still use ice as the cooling medium to preserve the catch until the vessel returns to port.

Many, but not all, of the comments above apply to the situation in Brazil. However, commercial refrigeration is extremely important to Brazil in the many areas of food storage and transport.

The manufacture of commercial refrigeration equipment in Brazil was mainly based on CFC 12 refrigerant, with only small quantities of R502 (a mixture of 48.8% HCFC 22 and 51.2% CFC 115), and HCFC 22. Since the early-1990's most new commercial refrigeration equipment for larger cold storage facilities and central systems for supermarkets, equipment that is usually designed and manufactured to the customer's specifications, has been manufactured using HCFC-22 as the refrigerant. Since 1997, the production of smaller unitary equipment items such as refrigerated beverage display cases and vending machines, ice cream freezers, etc., has also progressively been converted to the use of CFC-free refrigerants such as HFC 134a. This was initially to meet the demands of multinational clients, and later the demands of the larger Brazilian clients. The larger, well-established, manufacturers of unitary commercial refrigeration equipment who rapidly gained access to the new technology from chemical and component suppliers dominate this segment of the sector.

To date, the MLF has already approved 29 projects in the commercial refrigeration sector in Brazil. Excluding the three projects that were cancelled, the remaining 26 projects are to phase-out a total of 753.6 ODP tons of CFCs (536.1 ODP tons of CFC 11, 213.7 ODP tons of CFC 12, and 3.8 ODP tons of R502) at a cost of US$ 9,171,065. The average cost-effectiveness of these projects is then 12.17 US$/Kg.

The current status of these approved projects in the commercial refrigeration sector and an estimate of the trend in CFC phase-out from the remaining ongoing projects are summarized in Tables 4.8 and 4.9

Table 4.8 Status of MLF Approved Projects - Commercial Refrigeration Sector

Status of MLF Approved Projects	Number of Projects	ODP Tons to be phased-out by projects
Completed Projects	15	560.4
On-going Projects	11	193.2
Cancelled Projects	3	67.3
Total	29	820.9

Table 4.9 Estimate of Timing for Additional ODP tons of CFCs to be phased out by already approved projects

Estimate of Trend in CFC Phase-out from Ongoing Projects (ODP tons)					
2001	2002	2003	2004	2005	Total
59.0	27.9	62.0	44.3	0	193.2

The above projects include three projects to phase-out CFC consumption in the manufacture of refrigerated trucks and trailers.

The MLF has also approved a number of projects to eliminate CFC 11 consumption that because of MLF rules it classified under foam sector projects, but which the country classifies as consumption in the commercial refrigeration and refrigerated transport sectors. 11 such projects are ongoing and they will eliminate a total of 431.6 ODP tons of CFC 11.

The wide range of equipment and the large numbers of enterprises engaged in equipment manufacture means that detailed production statistics and CFC consumption trend data is not available for the sector. There are many SMEs in the commercial refrigeration manufacturing sector, some operating as contractors who build systems to clients requirements assembling components purchased from refrigeration equipment distributors or wholesalers.

Compressor sales provide a useful guide both to the size of the commercial refrigeration-manufacturing sector and refrigerant consumption, although clearly the sales for the manufacture of new equipment, and the sales for compressor replacement in the repair of existing equipment, need to be segregated.

Eight companies manufacture compressors in Brazil. Three of them produce mainly reciprocating hermetic compressors for domestic applications, one of them being a Brazilian capital owned company. The other companies manufacture open and semi-hermetic reciprocating compressors, as well as screw compressors. One company also rebuilds hermetic compressors.

An estimated breakdown of hermetic compressor sales in Brazil in 2000 by application is provided in Table 4.10.

Table 4.10 Sales of Hermetic Compressors by Application in 2000 (units)

APPLICATION	COMPRESSOR SALES
Domestic Refrigerator/Freezer OEMs	3.8 million
Drinking Water Cooler OEMs	0.6 Million
Commercial Refrigeration OEMs	0.5 million
Domestic & Commercial Refrigeration Replacement Market	0.8 million
Rebuilt Compressors	0.6 million
Domestic Air-Conditioning OEMs (HCFC 22)	1.0 million
TOTAL	**7.3 million**

In addition to the above sales of hermetic compressors, there were sales of approximately 80,000 condensing units.

The population of commercial refrigeration equipment based on hermetic compressors and the associated inventory of CFC 12 has been estimated based on data from the principal compressor manufacturers and local industry experts. The results are illustrated in the following Table 4.11.

Table 4.11 Commercial Refrigeration Equipment Population & CFC 12 Inventory

EQUIPMENT TYPE	EQUIPMENT INVENTORY (Units)	CFC 12 INVENTORY (Tonnes)
Unitary Equipment	7 million	2,800
Drinking Water Coolers	4 million	200
Condensing Unit Equipment	0.9 million	900
TOTAL	**11.9 million**	**3,900**

A detailed breakdown of compressor and condensing unit sales by refrigerant type is not available. However, if they were all were for CFC 12 duty, the sales of 1.1 million hermetic compressors and 80,000 condensing units to commercial refrigeration OEMs in 2000 would indicate a demand for CFC 12 of between 310 – 320 tonnes in the commercial refrigeration manufacturing sector. Projects already approved in the commercial refrigeration sector are to eliminate 213.7 tonnes of CFC 12, and of these 17 projects have been completed eliminating 180.1 tonnes of CFC 12. This data is consistent with the recent identification of numerous small enterprises in the sector that account for around 70 tonnes of CFC 11 and 75 tonnes of CFC 12 consumption.

There are three manufacturers of transport refrigeration systems in Brazil, Thermoking, Carrier-Transicold (multinationals) and Recrusul (National). These companies make their own systems (racks) with their own imported compressors (Thermoking, Carrier-Transicold) or they buy/import compressors from other enterprises, like Recrusul.

The manufacturers of refrigerated truck and trailers have two alternatives:

- Buy the complete refrigeration system from the above suppliers and install it in the trucks, or trailers, or
- Buy the individual components (compressor, heat exchanger etc) and put them all together to build a refrigeration system in the truck, or trailer.

There are enterprises in the refrigerated truck and trailer manufacturing sector who use both options, selecting the option according to client wishes, or cost.

As the manufacturers of transport refrigeration systems in Brazil have already converted to the use of non-CFC systems, any remaining use of CFC 12 in this sector is by the smaller companies buying individual components and building the systems themselves. The more readily identifiable enterprises have, where eligible, been included in the projects approved already in the commercial refrigeration sector. It is believed that there are perhaps a few very small enterprises remaining in the refrigerated transport manufacturing sector that are using CFC 12, and the consumption of CFC 12 by these enterprises is minimal.

As already stated above, enterprises who make only refrigerated truck or trailer bodies and consume only CFC 11 for production of the insulation foam are considers as foam projects. Any remaining enterprises that are consuming CFC 11 for such applications and that are eligible to receive MLF assistance to convert to CFC-free technology are included in the foam sector of this National CFC Phase-out Project.

4.1.3. Industrial Refrigeration Systems - Manufacturing & Installation

According to the 1999 Revision of the Brazil Country Programme, most facilities in the industrial refrigeration sector use ammonia as the refrigerant, while a small number operate with HCFC 22, and some very special facilities use other refrigerants, including CFCs, and hydrocarbons. Most of the facilities under construction in this sector in 1998 were already scheduled to operate with ammonia. With no reported consumption of CFC 12 for new industrial refrigeration equipment in 2000, CFC phase-out in this sector is considered complete.

4.1.4. Chillers - Manufacturing & Installation

The 1999 Brazil Country Programme estimated that there were 1,802 CFC based chillers in service in the central air conditioning sector, and based on an average refrigerant charge of 326 Kg CFC/system the total CFC refrigerant charge in these units was 588 tons of CFCs. Assuming that 30% of the refrigerant charge was replaced every year as a result of emissions from leaks, or during repair/servicing of the systems, the total annual CFC consumption for servicing was then estimated as approximately 176 tons.

Estimates based on surveys conducted for preparation of this National CFC Phase-out Project indicate that today, the number of CFC based chillers has reduced to around 700 through replacement with new non-CFC chillers.

ABRAVA estimates that 35% of the total inventory of centrifugal chillers is located in the State of São Paulo. In this way, 245 centrifugal chillers, representing around 80 installations of central air conditioning and industrial refrigeration, are located in São Paulo.

The remaining chillers are constituted mainly of HCFC-22 installations using reciprocating and screw compressors, and some direct expansion systems. The use of ammonia is restricted to industrial refrigeration facilities.

Centrifugal chillers are not manufactured in Brazil. The leading companies in the centrifugal chiller sector are Carrier, Trane, York, and Sulzer, and they all ceased production of CFC

based equipment in the early 1990's. New low-pressure centrifugal chillers previously based on CFC 11 now use HCFC 123, while those chillers based on CFC 12 were redesigned to use HFC 134a. Chillers based on HCFC 22 continue to be available. The Brazilian subsidiaries of the chiller suppliers act as agents, carrying out service and repairs, and stockists of spare parts.

With no consumption of either CFC 11 or CFC 12 for new central air-conditioning equipment and industrial refrigeration equipment in 2000, CFC phase-out in this sector is considered complete.

4.1.5. Mobile Air-Conditioning (MAC) – Manufacturing & Installation

This sector covers air-conditioning systems for automobiles, buses, and trucks. Under CONAMA Resolution No. 13 of 13 December 1995, the use of CFCs in mobile air-conditioning was prohibited in all new models launched after 01 January 1997, and in all new models from 01 January 2001. Some months prior to the 01 January 1997 ban on the use of CFCs in mobile air-conditioning in all new models, car manufacturers began replacing CFC 12 systems with systems using HFC 134a.

Three major multinational companies produce mobile air-conditioning (MAC) systems to meet local car manufacturers demand. Up until 2000, there was only one manufacturer of mobile air conditioning compressors in Brazil. About 30% of its production was exported to South America, Central Asia, South Africa and the USA. This company is already producing HFC 134a compressors. Another international manufacturer entered the Brazilian market in 2000 and it is using HFC 134a technology.

This ban was reinforced in CONAMA Resolution No. 267, which banned the use of CFC 12 in all new, domestic or imported, equipment, products, installations and systems, including mobile air-conditioning. This covers the installation of new CFC based MAC systems in all vehicles, new or old. The CFC phase-out in the mobile air-conditioning manufacturing sector is then considered complete and it was achieved without MLF assistance.

4.1.6. Domestic Air-Conditioning – Manufacturing & Installation

Five manufacturers produce around 1 million units a year of domestic air conditioning equipment. Two companies alone are responsible for 90% of this production. Product capacity ranges from 5,000 up to 30,000 BTU/h for window room air conditioners (95% of the national production), split units, and portable conditioning units. There is no Annex A CFC consumption; all production of domestic air-conditioning is based on the use of HCFC 22 refrigerant.

The two larger companies are associates of US companies and 35% of their production is for export. The largest export market is the USA, followed by other Latin America countries. Imports of domestic air-conditioning units are insignificant.

4.2. Refrigeration Servicing Sub-Sectors

4.2.1. Refrigeration Service Sector Overall

Since 1994 when the Country Program was prepared it has been recognized that the largest single CFC consuming sector in Brazil was the refrigeration and air-conditioning service sector. In the absence of any projects to reduce consumption in the service sector, the consumption in this sector has grown while consumption in other sectors has declined due to MLF investment projects, industry agreements, legislation, voluntary actions, etc. The

consumption in the service sector has become a progressively larger portion of the total Annex A CFC consumption in Brazil as shown by the data from PROZON in Table 4.12.

Table 4.12 Refrigeration & Air-conditioning Service Sector CFC Consumption

	CFC Consumption (ODP tons)						
	1994	1995	1996	1997	1998	1999	2000
Service Sector CFC Consumption	4,186	4,037	4,069	3,870	4,930	5,137	4,945
Total Annex A CFCs Consumption	10,751	10,880	10,872	9,815	9,543	11,612	9,276
Service Sector CFC Consumption as % of Total Annex A CFCs Consumption	39%	37%	37%	39%	52%	44%	53%

The major contributors to this consumption are the commercial, domestic, and industrial refrigeration service sectors, with consumption in 2000 totalling some 4,257 ODP tons of CFC 12. There are several reasons for this high level of consumption, the most important are:

- In the normal course of maintenance, service, and repair activities it is common practice that the refrigerant charge is vented, rather than being recovered and recycled. This is the direct consequence of the lack of a trained workforce that also lacks the appropriate tools, including the means for removing and recovering the refrigerant. It is exacerbated by the absence of awareness of the environmental problems resulting from CFC emissions to the atmosphere.

- The deteriorated state of many of the refrigeration and air-conditioning installations.

- The long working lifetimes of many of the refrigeration and air-conditioning installations. In contrast to what occurs in developed countries, the activity of repairing used refrigeration and air-conditioning equipment is a common practice in Brazil. This is due to the low cost of labour that makes repairs more attractive financially than replacement with new equipment. It is not uncommon for domestic refrigerators and freezers to have working lifetimes in excess of 20 years, and commercial refrigeration equipment lifetimes can extend as long as 15 years. Data on a sample of 47 centrifugal chillers in Sao Paulo and Rio de Janeiro revealed that 45% were between 27 – 32 years old.

Reliable sources estimate that throughout Brazil some 60,000 service mechanics are involved in the refrigeration and air-conditioning service sector. The majority render low quality services because they lack training and the means to acquire appropriate tools. The remainder, numbering less than 5,000, are mechanics who are associated with OEM authorized repair shops. They can render better quality services since they have received some technical training and have better working conditions.

The distribution of the refrigeration and air-conditioning service mechanics by region, and by city/state, is illustrated in the following Tables 4.13 and 4.14:

Table 4.13 Distribution of Refrigeration and A/C Service Mechanics by Region

Region	Number of Mechanics	% of Total
North	2,430	4.05
North-East	11,598	19.33
South-East	35,232	58.72
South	7,812	13.02
Centre-West	2,928	4.88
Total	60,000	100

Source: EMBRACO (Bola Preta Circulation Statistics)

Table 4.14 Distribution of Refrigeration and A/C Service Mechanics by City/State

City/State	Number of Mechanics	% of Total
ACRE	90	0.15
ALAGOAS	606	1.01
AMAPA	6	0.01
AMAZONAS	372	0.62
BAHIA	3,156	5.26
CEARA	1,518	2.53
DISTRITO FEDERAL	696	1.16
ESPIRITO SANTO	870	1.45
GOIAS	552	0.92
MARANHAO	618	1.03
MATO GROSSO	762	1.27
MATO GROSSO DO SUL	918	1.53
MINAS GERAIS	3,828	6.38
PARA	1,464	2.44
PARAIBA	678	1.13
PARANA	2,550	4.25
PERNAMBUCO	3,090	5.15
PIAUI	486	0.81
RIO GRANDE DO NORTE	990	1.65
RIO GRANDE DO SUL	3,198	5.33
RIO DE JANEIRO	10,668	17.78
RONDONIA	444	0.74
RORAIMA	24	0.04
SANTA CATARINA	2,058	3.43
SAO PAULO	19,878	33.13
SERGIPE	456	0.76
TOCANTINS	24	0.04
Total	60,000	100

Source: EMBRACO (Bola Preta Circulation Statistics)

4.2.2. Domestic Refrigeration - Servicing

Due to the huge number of mechanics involved in the refrigeration and air-conditioning service sector it is impossible to obtain accurate data on the CFC consumption by sub-sector.

The Brazilian domestic appliances manufacturers association (ELETROS) has advised that it's members have some 1,945 authorised workshops employing 3,000 technicians engaged in servicing domestic refrigerators and freezers. Actual CFC consumption data even for these authorised workshops does not exist. In 1997, ELETROS members estimated the annual consumption by the authorised workshops was 178 tonnes of CFC 12. This estimate was based on compressor sales for the replacement market and the actual consumption over a period of 1 month at 309 authorised workshops of one ELETROS member company. The consumption of CFC 12 for the service of domestic refrigerators and freezers by the informal sector is much more difficult to estimate and ELETROS has suggested that the authorised workshops may account for only 20% of the total sub-sector consumption.

Several years ago there was some consumption of CFC 11 for flushing refrigerator systems during repair operations. The view of local industry experts is that there is no longer any consumption of CFC 11 for this purpose, and that the current practice is to use nitrogen.

Based on an ongoing high level of compressor sales to the replacement market, it is then believed that the total consumption of CFC 12 in the domestic refrigeration service sub-sector is in the range of 850 – 950 ODP tons. This represents around 10% of the installed charge of 8,250 ODP tons of CFC 12 that is based on an estimated population of domestic refrigerators and freezers in the Brazilian market that now totals some 62 million units, 55 million of which are CFC 12 based and contain an average charge of 150 grams CFC 12.

4.2.3. Commercial Refrigeration - Servicing

For the reasons already mentioned in the preceding sub-sector, because of the 60,000 mechanics involved in the refrigeration and air-conditioning service sector it is impossible to obtain accurate data on the CFC consumption in the commercial refrigeration service sub-sector, although undoubtedly it is the largest consumer of CFC 12.

Surveys on CFC consumption in developed countries in the early 1990's indicated that within the service sectors the largest consumption of CFC 12 was in the retail area. A 1996 NEILSEN census report estimated the inventory of CFC 12 in equipment in the food retail sector in Brazil as 4,390 ODP tons.

While recharge rates of 20% – 25% of the installed charge in commercial refrigeration in the retail food sector might be the norm in developed countries, much higher rates are found in developing countries. The 1994 Brazilian Country Programme suggests recharge rates of 80% based on a survey of medium and large supermarkets in Sao Paulo. Based on the NEILSEN inventory and recharge rates of 60% - 80%, the annual consumption of CFC 12 for service in the food retail sector in Brazil could well be in the range of 2,630 to 3,500 ODP tons.

Since the early 1990's most new commercial refrigeration equipment for larger cold storage facilities and central systems for supermarkets, equipment that is usually designed and manufactured to the customer's specifications, has been manufactured using HCFC-22. However, a March 2002 survey of the equipment operated by the largest supermarket chain in Brazil confirmed that there is still a large population of older CFC 12 based equipment in operation. This supermarket survey also obtained data on the CFC 12 consumption for service and repair of this equipment, which indicated a recharge rate of 72% of initial charge.

Extrapolation of the data obtained from the survey indicates that the total annual consumption of CFC 12 for service and repair activities related solely to central systems for supermarkets is around 350 ODP tons. To this must be added the consumption for other open-drive compressor based systems in large cold storage facilities.

As indicated in **4.1.2.**, informed estimates put the existing population of commercial refrigeration equipment based on hermetic compressors in Brazil at a total of 11.9 million units with an inventory of 3,900 ODP tons of CFC 12.

In addition to the equipment mentioned above, there will be an existing population of equipment and an inventory of CFC 12 in the transport refrigeration sub-sector. Reliable data is not available for this sub-sector but, while small in comparison to the static equipment population and CFC 12 inventory statistics, it will contribute to the overall consumption of CFC 12 for service activities. Because of price differentials between CFC 12 and HFC 134a refrigerants there have been reports in some countries of fairly widespread use of CFC 12 to service refrigerated transport trucks fitted with HFC-134a refrigeration systems. It is not known if such activities are practiced in the Brazilian market, and if so, to what extent. The recent closer alignment of CFC 12 and HFC 134a prices in Brazil due to higher CFC 12 prices should now mitigate against such practices.

There are no refrigerated shipping container (reefer box) manufacturing facilities in Brazil but there are facilities to service refrigerated containers. These containers are mostly owned by large international container fleet operators. The international nature of the business means that they are now predominantly based on HFC 134a, with some using HCFC 22. A very small number using CFC 12 may still operate solely in the South American region, but the CFC 12 consumption will be insignificant, and it will be eliminated in the next 2 - 3 years.

In conclusion then, it can be accepted that the annual consumption of CFC 12 for service and repair activities in the commercial refrigeration service sub-sector in Brazil is of the order of 3,300 ODP tons. This is in line with the data in the Brazilian Country Programme and PROZON estimates.

One would not expect to find the practice of re-charging, or “topping-up”, of HFC 134a refrigeration systems with CFC 12 in the commercial refrigeration sector (a not uncommon practice in MAC in some countries). A major OEM has identified the existence of this practice in Brazil although it is not known how widespread it is. The recent narrowing of the gap in the cost of CFC 12 and HFC 134a should limit, or end, this activity.

4.2.4. Chillers - Servicing

Central air conditioning can be divided into two broad but distinctive categories:

- Large capacity chillers, operated by centrifugal compressors;
- Medium capacity chillers and "self-contained" air-conditioning equipment that mostly operate with reciprocating compressors.

The use of CFCs is confined to the large centrifugal chillers designed to use CFCs and that were installed pre-1993. New installations since the early 1990’s have used centrifugal chillers based on HCFC 123, HFC 134a, or HCFC 22.

The medium capacity chillers and "self-contained" air-conditioning equipment in the second category are based almost exclusively on refrigerant HCFC 22.

In 1999 it was estimated that there were 1,802 CFC based chillers in service in the industrial refrigeration/central air conditioning sector, and based on an average refrigerant charge of

326 Kg CFC/system the total CFC refrigerant charge in these units was 588 tons of CFCs. Assuming that 30% of the refrigerant charge was replaced every year as a result of emissions from leaks, or during repair/servicing of the systems, the total annual CFC consumption for servicing was then estimated as approximately 176 tons.

Estimates based on surveys conducted for preparation of this National CFC Phase-out Project indicate that today, the number of CFC based chillers has reduced to around 700 through replacement with new non-CFC chillers.

The refrigeration and ventilation industry association, ABRAVA estimates that 35% of the total inventory of centrifugal chillers is located in the State of São Paulo. In this way, 245 centrifugal chillers, representing around 80 installations of central air conditioning and industrial refrigeration, are located in São Paulo.

In spite of, or maybe because of, the fact that there are only four suppliers of centrifugal chillers active in the Brazilian market, it has proved impossible to verify this data, or to obtain data from these enterprises on the total inventory of centrifugal chillers in the country, the installed charge by refrigerant type, or information on the consumption of CFCs for servicing.

The consumption of CFCs for servicing chillers in 2000 was therefore derived from other industry sources and in 2000 this amounted to 28 ODP tons of CFC 11 and 60 ODP tons of CFC 12.

Many facilities in the industrial refrigeration sector use ammonia as the refrigerant, while a small number operate with HCFC 22, and some very special facilities use other refrigerants, including CFCs, and hydrocarbons.

4.2.5. Mobile Air-conditioning (MAC) – Servicing

Due to the design of mobile air-conditioning systems and the rigorous conditions under which they are required to operate there is inevitably refrigerant loss during operation. It is generally accepted for estimating refrigerant consumption for servicing MAC systems that each vehicle will require a new refrigerant charge every 2 years. A first approximation of the consumption of CFC 12 for MAC service can then be obtained from information on the existing population of vehicles with CFC based MAC.

Under CONAMA Resolution No. 13 of 13 December 1995, the use of CFCs in mobile air-conditioning was prohibited in all new models launched after 01 January 1997, and in all new models from 01 January 2001. CONAMA Resolution 267 subsequently banned the use of CFC 12 in all new, domestic or imported, equipment, products, installations and systems, including mobile air-conditioning. This covers the installation of CFC based MAC systems in all vehicles, new or old.

Some months prior to the 01 January 1997 ban on the use of CFCs in mobile air-conditioning in all new models, car manufacturers began replacing CFC 12 systems with systems using HFC 134a. It is assumed, therefore, that since 1997 all new vehicle MAC systems in Brazil have been based on HFC 134a.

A survey of the MAC sector in 1999 suggested that there were some 3,900 workshops (2,600 in the formal sector and 1,300 in the informal sector), and 6,000 mechanics (4,000 in the formal sector and 2,000 in the informal sector).

The 1999 MAC survey report provides reasonable justification for these numbers based on significant changes in the sector between 1992 and 1998 as illustrated in Table 4.15.

Table 4.15 Vehicles fitted with MAC 1992 versus 1998 (1999 MAC Survey)

No. of Vehicles with MAC			
1992		**1998**	
Original Equipment	**Aftermarket**	**Original Equipment**	**Aftermarket**
55,000	50,000	388,000	60,000

This growth in the number of cars equipped with MAC had a corresponding effect on the automobile service sector.

According to the National Syndicate of Automobile Repair Shops (SINDIREPA), the number of general and specialized automobile repair shops dropped, during the same period, from 250,000 to 172,000. This is explained by the technological changes that happened in the Brazilian car industry, such as, the use of embarked electronics. Many general repair shop owners were not able to cope with the costs of these changes (new testing equipment, training of mechanics) and they closed down.

At the same time, the changes that took place in the MAC sector created new servicing opportunities for those that stayed in business. The growing number of cars with MAC encouraged more authorized vehicle dealers (AVD) to provide MAC service. Information from the industry indicated that, apart from these AVD, approximately 1% of general and specialized automobile repair shops were also servicing MAC in 1998. This total of some 1,700 repair shops included approximately 400 specialized MAC Service Centres dealing exclusively with MAC.

Though the number of MAC Service Centres remained relatively stable, a greater number of the independent general repair shops and the newly established "Auto Centres" (e.g. the *"Precision Tune"* chain) also began incorporating MAC servicing in their activities.

A statement from the National Federation of Authorized Automobile Dealers (FENABRAVE) in September 1999 claimed that owing to the establishment of new automobile plants and brands in Brazil between 1995 and 1999, the number of authorized vehicle dealers (AVD) had grown from 3,000 to 4,500. Meanwhile, according to SINDIREPA, in 1992 when only 23% of the authorized vehicle dealers serviced MAC, by 1999 the number had risen to 48%.

The conclusions of the 1999 MAC survey were, therefore, that there were then approximately 3,900 enterprises servicing MAC systems in Brazil, including 2,200 AVD, 400 specialized MAC Service Centres, and 1,300 independent general repair shops.

As vehicle warranties expire and the vehicle value decreases, repair and servicing (including MAC) tends to move from the authorized vehicle dealer or specialized MAC Service Centres to the independent general repair shops. As older vehicles have CFC 12 based MAC systems then many of these independent general repair shops that often lack MAC servicing equipment were consuming relatively large amounts of this type of refrigerant.

The overview of the MAC service sector in the 1999 MAC survey report brought together data from two main sources, the automobile industry, and the mobile air conditioning service enterprises.

According to the National Automobile Manufacturers Association (ANFAVEA), the production of automobiles incorporating MAC between 1995 and 2000 was as indicated in Table 4.16.

Table 4.16 Car Production & Car Production with MAC in Brazil 1995 - 2000

Year	Car production	Cars with AC *	%
1995	1,629,008	210,000	12.89
1996	1,804,328	290,000	16.07
1997	2,069,703	550,000	26.57
1998	1,585,630	388,000	24.47
1999	1,279,500	346,000	27.04
2000 (estimated)	1,532,000	502,000	32.76

***Estimated (there are no official figures)**

Due to the impact of CONAMA Resolution No. 13 and the ban on the use of CFC 12 MAC systems in new models launched after 01 January 1997, the growth is assumed to be largely in HFC 134a based MAC systems.

Estimates of the existing vehicle population in Brazil with MAC in 1998, including both CFC 12 and HFC 134a based systems, suggested some 2.91 million vehicles were equipped with CFC 12 based MAC systems (Table 4.17.).

Table 4.17 Existing Car & Light Vehicle Population with MAC - 1998

Number of Cars & Light Vehicles with MAC (1998)*		
	Number	**%**
Total Existing Vehicle Population	20,580,00	-
Existing Population with CFC 12 MAC	2,910,000	14.1
Existing Population with HFC 134[a] MAC	1,600,000	7.8
Total with MAC	4,510,000	21.9

***Estimated (there are no official figures).**

Using this data, the demand for CFC 12 in the MAC sector in 1998 is estimated to be 1,397 tons (Table 4.18).

Table 4.18 Estimated Annual CFC 12 demand for MAC Service in 1998 by Vehicles

Number of Existing Vehicles with CFC 12 MAC in 1998	2.91 million
Assumed Average Charge Size (kilogram)	0.96
Number of years per Complete Recharge	2.0
Annual Estimated Total CFC 12 Consumption (Tonnes)	**1,397**

The MAC survey included sending questionnaires to vehicle service enterprises that installed and serviced MAC. These included AVD, specialised MAC Service Centres (MSC), and large independent repair shops. Out of the 1,200 questionnaires, responses were received from only 158 (13.2%) of the MAC service enterprises. However, the respondents were considered as being a good representation of the MAC service sector.

Extrapolating the data on virgin CFC 12 consumption per month for the AVD, MAC Service Centres, and the independent general repair shops from the responses to the MAC Survey questionnaires results in the following estimate of the annual consumption of CFC 12 for MAC service activities in the car and light vehicle sector in 1998. (Table 4.19)

Table 4.19 Estimated Annual CFC 12 demand for MAC Service in 1998 by USERS

Consumption Database	**Extrapolated Annual CFC 12 Consumption**
Average virgin R12 consumption by AVD = 4.17 kg/month x 2,200 AVD x 12 = 110 tonnes/year	110
Average virgin R12 consumption by MSC + Independent = 71.91 kg/month x 1,700 x 12 = 1,467 tonnes/year	1,467
Annual Estimated Total CFC 12 Consumption (Tonnes)	**1,577**

Notwithstanding the fact that the foregoing estimates of CFC 12 consumption for MAC servicing are only for passenger cars and light vehicles and they do not include MAC in trucks, buses, tourist coaches, and other foams of public transport, many different factors need to be taken into account in estimating the consumption in the sector in 2000. These include:

Until the mid-1990's, MAC in passenger cars was considered a luxury and it was only fitted as standard equipment in top of the range models, or imported vehicles.

A major part of the Brazilian car population consists of small "economy" models and the cost of aftermarket installation of MAC is considered by car owners as disproportionately high relative to the vehicle cost.

The climate in a large geographic area of Brazil, particularly the densely populated areas where the majority of passenger vehicles are found, is not tropical. MAC is then usually only required during the height of summer.

Given that MAC is certainly not considered "essential", or even necessary, by many car owners, when a MAC system fails for any reason in a car that is more than 6 - 7 years old it is rarely repaired.

Observations of traffic around Sao Paulo in summer 2002 revealed only very small numbers of vehicles with closed windows, the preference apparently being for "fresh-air" cooling.

The statistical data on vehicles with MAC is based purely on estimates, and no official data exists.

The 1999 MAC survey achieved only a 13.2% response to the questionnaires distributed on CFC consumption in the MAC service sector. It must then be recognised that extrapolation of the data from such a limited response may produce distorted consumption data.

From further discussions with CFC suppliers and industry representatives, some of who contributed to the 1999 MAC survey, it was concluded that the total consumption of CFC 12 in the MAC service sector in 2000, for all applications, was around 600 – 660 tonnes.

For the purposes of this National CFC Phase-out project and in the absence of any more accurate data, the higher figure of 660 ODP tons has been adopted.

The introduction and promotion of HFC 134a MAC since 1997 means that most of the new equipment and training that has been acquired has tended to be for HFC 134a rather than for CFC 12. A very small number of service shops have already invested in refrigerant recycling machines, though they are principally to recycle HFC 134a because of the high cost.

When there is a significant cost difference between CFC 12 and HFC 134a there will always be the risk of "reverse retrofit" of HFC 134a systems to use CFC 12, or the "topping up" of HFC 134a systems with CFC 12. It is not clear how widespread this practice may be in Brazil but, as the cost of CFC 12 has recently increased to almost the same as that for HFC 134a, it can be anticipated that this practice will decline.

5. OTHER USES (including Sterilants)

There may be a small number of uses of CFCs in Brazil that are not covered in the previous sections. These include certain testing procedures and the sterilization of medical equipment. These "other uses" may be negligible consumers of CFCs, but they can be important to the users.

Article 4^0 of CONAMA Resolution 13 (1995) banned CFCs in "All uses as sterilants" from 01 January 2001 in new, domestic or imported, equipment, products and systems. This ban on the use of CFCs in uses as sterilants was maintained when CONAMA Resolution 267 (2000) superseded Resolution 13. "New" is defined as post 01 January 2001. **There are no controls on the ongoing use of CFC 12 used in mixtures with ethylene oxide as a sterilant in existing equipment**.

A CFC 113 Solvents project BRA/SOL/18/INV/36 was approved in May 1996 that included the consumption of 14 ODP tons of CFC 12 used in the sterilisation of intravenous tubes and catheters, blood oxygenators and containers, cannulas, anaesthesia instruments, and urology tubes. The enterprise concerned was to eliminate CFC 12 consumption by replacing existing equipment and converting to the use of an ethylene oxide/carbon dioxide sterilant mixture. The project was cancelled as the enterprise was unable to proceed as the approved funding (US$ 317,492 excluding Agency Support Costs) was insufficient and it had no access to supplementary funds.

It is noted that Article 3^0 and Article 4^0 CONAMA Resolution 267 (2000) eventually restricts the import of CFC 12 to meet the applications considered to be "essential use", as defined in Article 4 of the Resolution.

Article 4^0 of the Resolution states that "essential uses" are considered to be the uses and/or applications allowed for using the substances contained in Annexes A and B of the Montreal Protocol, namely:

I - for medicinal purposes and pharmaceutical formulations for medication in the form of aerosols, such as Metered Dose Inhalants and/or the like, in the form of sprays for nasal or oral use;

II - as an agent in chemical and analytical processes and as a reagent in scientific research;
III - in fire extinction in air and maritime travel, non-specified military applications, cultural and artistic collections, electrical and nuclear energy transformation and generation plants, and on marine platforms for petroleum extraction - Halons: bromochlorodifluoromethane (Halons 1211) and bromotrifluoromethane (Halons 1301).

The Police in some countries are known to have used CFC 113 as a solvent for some special tasks such as testing for fingerprints. Typically there may be other small (< 100 Kg/year) quantities of CFC solvents used in Government Laboratories or Universities for analytical testing activities. This may involve laboratory analyses for government departments including those for prosecution/legal cases.

Such uses should be identified and actions need to be taken as necessary to:

Establish the status of the enterprise that was using CFC 12 for sterilisation to see what assistance is required to eliminate any remaining CFC 12 consumption.

Seek alternative solvents, or create an exemption mechanism to allow for the import of these substances for internationally exempted uses i.e. for "laboratory and analytical uses".

Inform all testing laboratories, the armed forces, and the Police about the possible future shortage of supply of CFCs, and provide information on international efforts to phase out these uses.

Inform all medical facilities of possible future shortages of supply of CFCs, particularly CFC 12 if use in mixtures with ethylene oxide for sterilisation is identified.

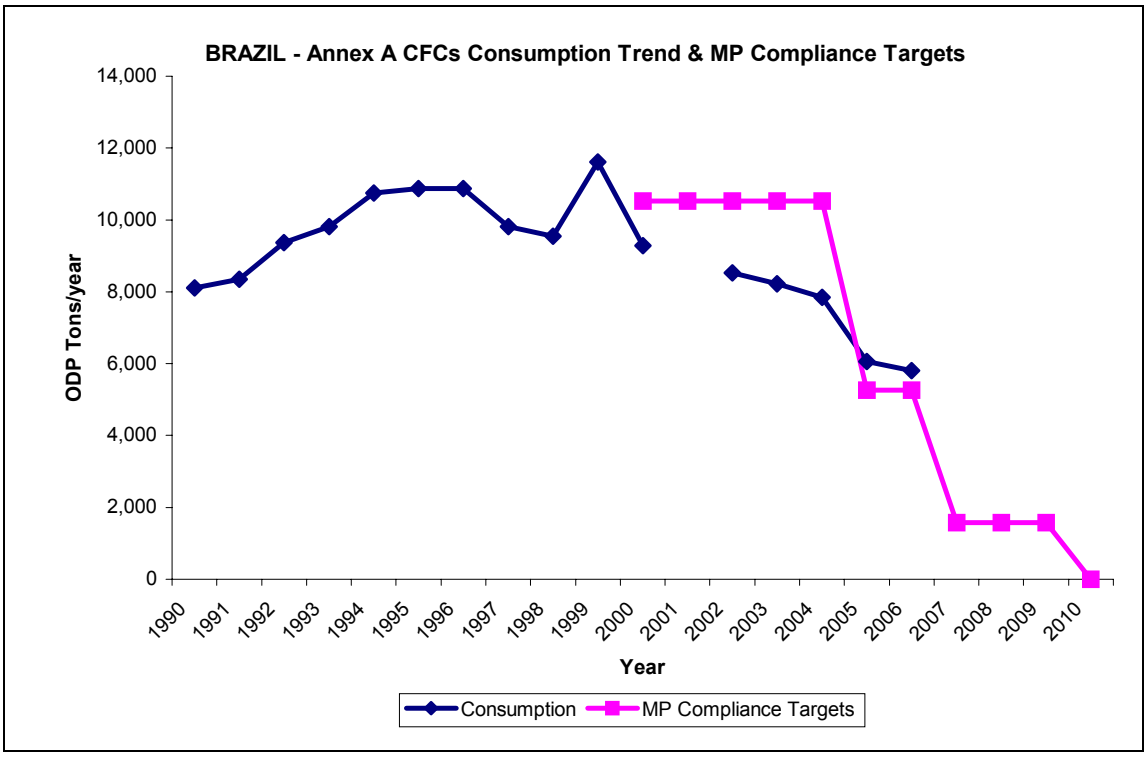
CHAPTER 5 - NATIONAL CFC PHASE-OUT PLAN

1. INTRODUCTION

As mentioned in Chapter 1, in order to comply with the Montreal Protocol, Brazil must freeze its consumption of the Annex A CFCs at 10,521 ODP tons by 2000 and then reduce this to 5,261 ODP tons by 2005 and 1,578 ODP tons by 2007, before complete phase-out in 2010.

In 2000 there was consumption of 4,945 ODP tons of Annex A CFCs in the refrigeration and air-conditioning service sectors and a trend of growth in consumption in the sector. There was also consumption of 4,331 ODP tons of Annex A CFCs in the refrigeration, foam, solvents, and aerosols manufacturing sectors. In order to meet its 50% reduction target for Annex A CFCs in 2005, Brazil must then eliminate a minimum of 4,015 ODP tons from the total consumption of 9,276 ODP tons of CFC consumption in 2000.

Brazil has ongoing projects in the refrigeration and foam manufacturing sectors that, if completed on schedule, will eliminate a total of 3,213 ODP tons of Annex A CFCs by the end of 2005. This is some 802 ODP tons short of the 4,015 ODP tons reduction required to achieve compliance in 2005. The balance of CFCs to be eliminated by ongoing projects, a further 261 ODP tons, will be eliminated during 2005 if these projects are completed on schedule. This would still leave Brazil in non-compliance with its 2005 Montreal Protocol CFC consumption obligations, even in 2006.



Graph 4. CFC Consumption Trend based on Actual Consumption to 2000, Projected Consumption 2002 – 2006 based on Scheduled Completion of Ongoing Projects, and MP Compliance Levels

Unless measures are taken rapidly to strengthen and to strictly enforce CONAMA Resolution 267, then there is a clear risk that Brazil may not achieve compliance with the 50% reduction target in 2005.

Brazil plans to phase-out CFC consumption by 01 January 2007, some 3 years ahead of the phase-out date mandated by the Montreal Protocol. In addition to the total of 3,474 ODP tons of CFCs (3,207 ODP tons of CFC 11 and 267 ODP tons of CFC 12) that will be phased out by completion of ongoing projects by the end of 2005 if they are completed on time, Brazil will have to complete the phase-out of a further a further 5,802 ODP tons of CFCs in 2006.

There are serious financial implications for the country in achieving compliance in 2005, and the complete phase-out of CFC consumption by 01 January 2007 unless substantial further assistance from the Multilateral Fund is made available immediately, and the Government commits itself to take all the necessary actions required to support such a programme of rapid reduction in the remaining CFC consumption in the country.

As the following data demonstrates, one of the sectors that require immediate assistance to reduce consumption is the refrigeration and air-conditioning service sector.

	CFC 11 (ODP tons)	CFC 12 (ODP tons)
Total CFC consumption to be eliminated by ongoing projects	3,207	267
Total Remaining CFC 11 and CFC 12 consumption eligible for MLF assistance under Decision 35/57	189	5,566
CFC consumption by refrigeration and air-conditioning service sector in 2000	28	4,917

Without assistance, refrigeration and air-conditioning end-users will face serious problems in maintaining their equipment in operation and they could face substantial direct and indirect financial penalties related to the need to retrofit or replace existing equipment, and consequential losses resulting from spoiled goods.

It is worth noting that if Brazil was to stay with the CFC consumption phase-down and phase-out schedule as required by the Montreal Protocol it would have to reduce its CFC consumption to 1,578 ODP tons of CFCs in 2007 in order to achieve compliance with the Montreal Protocol 85% reduction target. Without any additional measures, this would require the elimination of a further 4,224 ODP tons of CFCs in addition to what will be phased-out by ongoing projects.

2. PROPOSED POLICIES AND STRATEGIES

It is Brazilian Government policy to meet its Montreal Protocol obligations while reducing the potential negative impacts on the country. Recognizing these commitments, the Government has already introduced legislation to progressively phase-out the remaining CFC uses in the manufacturing sector, and totally phase-out CFC consumption by 2007, taking into consideration that financial assistance would be available to Brazil.

Today, the reductions in CFC consumption mandated by CONAMA Resolution 267 in 2000 by way of import controls on CFC 11 and CFC 12 are clearly too stringent in the case of

CFC 12, as the commensurate assistance from the Multilateral Fund has not yet been obtained.

In addition, the Government intends to strengthen the legislation relating to CFC use to establish legal requirements to pre-empt back-conversion of non-CFC equipment. This requires urgent action and it is critical to the success of sustainable phase-out of CFCs in the servicing sector.

There is remaining fundable consumption of approximately 800 ODP tons of Annex A CFCs in enterprises in the manufacturing sector that is eligible for assistance from the Multilateral Fund. The Brazilian Government is seeking funding from the Multilateral Fund to support conversion at these enterprises. The Government will take all necessary measure to ensure that the conversion to non-CFC technology at these enterprises is completed as soon as possible, but by no later than then end of 2006.

As already mentioned, significant reductions in the demand for CFC 12 in the refrigeration and air-conditioning services sector must also be achieved in the next three years if Brazil is to be in compliance with the 50% consumption reduction target in 2005. Further rapid reductions in consumption in this sector will be required to achieve CFC phase-out by 2007.

A cause of some concern in meeting these targets is the underlying growth in the consumption of CFC 12 for refrigeration and air-conditioning service activities.

While CFC 11 consumption in the service sector is small, only 28 ODP tons, it is important as it is for centrifugal chillers. The consumption of CFC 12 in the service sector is greatest in the commercial refrigeration sub-sector (67%), followed by the domestic refrigeration sub-sector (18%), the MAC sub-sector (13%), and the industrial refrigeration and central air-conditioning sub-sectors (<2%). To help reduce the demand of CFCs in the servicing sector, the Government plans to establish a regulatory system to prevent the use of CFCs in non-CFC refrigeration and air-conditioning systems.

Given the size of the Brazil and the huge inventory of installed refrigeration equipment, it will also be important to minimise the negative impact on the country after CFCs have been phased-out. The Government will therefore look for ways disseminate the information concerning CFC phase-out in 2007 in order to provide advance notice to all end-users that they should take action, sooner rather than later, to eliminate their dependence on CFCs in all their operations.

3. IMPACT OF APPROVED PROJECTS AND NEWLY PROPOSED ACTIVITIES

The impact of various investment, technical assistance, and regulatory activities proposed under this National CFC Phase-out Plan is shown in Tables 5.1 and 5.2 (Pages 66 & 67).

In 2000, Brazil consumed 9,276 ODP tons of Annex A CFCs. With no further intervention from the Multilateral Fund or from the Government, it is expected that the current consumption level of 9,276 ODP tons a year will decrease to 5,802 ODP tons in 2006 due to the completion of all remaining investment projects already approved by the Executive Committee of the Multilateral Fund and other supporting measures carried out by the Government.

The Foam Sector consumed the following quantities of CFCs in 2000:

3,281 ODP tons of CFC 11
580 ODP tons of CFC 12

CONAMA Resolution 267 includes a strict import quota system for CFC 12, commencing in 2001 and ending in a ban on CFC 12 imports effective 01 January 2007. This legislation on CFC 12 imports has implications for enterprises manufacturing polystyrene and polyethylene foam. The import controls on CFC 11 also start in 2001 but are less well defined and Article 3 of the same CONAMA Resolution states that the import of CFC 11 is permitted only for consumption by those companies registered with the Brazilian Federal Environmental Agency (IBAMA) that have projects to convert to CFC-free technologies that are in the process of implementation, or preparation. The Government's intention is to also phase-out CFC 11 consumption by a ban on all CFC 11 imports effective 01 January 2007.

There are 89 on-going projects in the foam sector, including 15 projects approved at the 36th ExCom Meeting in March 2002, which will eliminate a total of 3,250.7 ODP tons of CFCs (3,207.2 t CFC 11 and 43.5 t of CFC 12). Included within the foam sector are numerous projects that are classified as "foam" under MLF reporting, but that PROZON classifies as Transport Refrigeration. The ODS phase-out from the 89 on-going projects is projected according to the following schedule:

CFCs to be phased out by ongoing projects in foam sector (ODP tons)							
2001	2002	2003	2004	2005	2006	2007	Total
685.6	257.4	304.0	1742.9	260.8	0	0	3250.7

The remaining consumption considered as eligible for MLF funding under ExCom Decision 35/57 and for which funding is requested under the National Phase-out Plan consists of the following:

74 ODP tons of CFC 11
537 ODP tons of CFC 12

Historically, the foam sector has received the largest amount of funding in Brazil under the MLF, and consequently is well organized and positioned to complete the phase-out in an orderly manner and according to the required phase-out schedules. Identification of remaining CFC-consuming enterprises is summarized in the table below. Reported consumption far exceeds the remaining "fundable" consumption, and may be explained by various factors including the current definition of a completed project (based not on the absence of CFCs but also based on the fulfilment of several requirements, including destruction of baseline equipment), and inconsistencies in reporting mechanisms throughout the programme.

Sub-Sector	No. of enterprises	Identified CFC 11 consumption	Identified CFC 12 consumption	Remaining CFC eligible for funding
Rigid Polyurethane Foam	32	620	0	10
Flexible Molded/Integral Skin polyurethane foam	3	25	0	10
Flexible Polyurethane Foam	22	790	0	34
Polyethylene/Polystyrene	2	0	537	537
Multiple Sub-sectors	5	310	0	20
TOTALS	**64**	**1745**	**537**	**611**

The remaining consumption will be addressed in CFC phase-out projects according to the following strategy.

- Enterprises consuming larger amounts of CFC's (>10 t/y) are best served by individual projects, typically including replacement or retrofit of equipment, as well as covering trials and technical assistance for conversion.
- Smaller enterprises typically do not possess the in-house expertise required for ODS phase-out, and rely heavily in their chemical supplier for technical assistance. These smaller enterprises can be grouped with chemical suppliers to help provide conversion assistance, and may or may not include new equipment as part of the conversion. This approach has been successfully applied numerous times in Brazil and other countries, and it is expected to work well in this instance as well.
- There are also numerous distributors serving the smallest users, who typically purchase extremely small quantities of premixed systems each year. These distributors have a responsibility to educate their customers about CFC elimination, and to ensure that any technical needs of their customers are met during this phase-out process.

MLF funding is required to accomplish this task, but creativity and resourcefulness will be required to address all remaining actual eligible consumption using the available resources.

The Refrigeration & Air-conditioning Sectors consumed the following quantities of CFCs in 2000:

Manufacturing Sector	235 ODP tons of CFC 11 132 ODP tons of CFC 12
Service Sector	28 ODP tons CFC 11 4,917 ODP tons CFC 12

In the refrigeration sector, there are 13 on-going investment projects that are scheduled to be completed no later than 2004. Therefore, the full impact of these projects, reduction of CFC 11 demand by 135.7 ODP tons, CFC 12 by 54.5 ODP tons and R502 by 3.0 ODP tons, will be realized by 2005.

Brazil lacks projects to reduce CFC consumption in the refrigeration and air-conditioning service sector. A CFC 12 recovery, recycling, and conservation project for the domestic refrigeration maintenance and repair shops was approved in 1992 but was subsequently cancelled.

In 1993, a bilateral assistance project was approved that involved a workshop to facilitate transfer of CFC phase-out technologies in the refrigeration and air-conditioning sectors between Canadian and Brazilian industrial representatives and to identify additional areas of cooperation (training, recovery and recycling, investment projects). The project was completed in 1994 but no directly tangible results from this project can be identified.

In July 2001, a German bilateral assistance pilot training project for the refrigeration maintenance sector was approved. This is a pilot training programme in good practices that was approved on the basis that it would be concurrent with the preparation of the strategy for the service sector. It was considered essential to identify, with a high level of accuracy, the number and geographical distribution of refrigeration technicians. This is only a pilot training programme, and it recognised that a nation-wide programme will be required in the future. This project was to be implemented within a short time frame and it was to contribute to the preparation and implementation of the RMP for Brazil.

To date little progress has been made in implementation of this project, and the Brazilian Government, concerned about not meeting its compliance target in 2005, wishes to see a National CFC Phase-out Plan approved and implemented as rapidly as possible. It also recognises that a wider ranging technician training project must be prepared and implemented as a matter of urgency without waiting for implementation and evaluation of the pilot training project.

CONAMA Resolution No. 267 of 14 September 2000 requires that during each and every process of removal of controlled substances from the place of its installation or in repair and maintenance workshops, the refrigerants must be appropriately collected, packaged and later sent to incineration centers or recycling units licensed by the competent environmental agency. In the absence of incinerators or recycling centers licensed by the competent environmental agency, the substances must be appropriately packaged in containers that meet the standards NBR 12,790 and NBR 12,791, or later standards.

While this may be interpreted as being intended to achieve a reduction in the consumption of CFCs in the service sector it will not be effective unless the means to recover and recycle CFCs are provided.

Considering the wide distribution of CFC consumption in the refrigeration and air-conditioning service sector, from the individually small amounts in the domestic refrigeration sector, to the large amounts in industrial refrigeration and central air-conditioning sectors, then MLF assistance for individual sub-sector CFC 12 recovery and CFC recovery/recycling projects, and a National CFC 12 reclaim/recycling project is urgently required. The strategy for each sub-sector id different and this is explained in the subsequent parts of this chapter of the National CFC Phase-out Project.

The Domestic Refrigeration Sector consumed the following quantities of CFCs in 2000:

Manufacturing	-	28.7 ODP tons of CFC 11
	-	1.7 ODP tons of CFC 12
Service	-	900 ODP tons of CFC 12

All the manufacturers of domestic refrigerators and freezers in Brazil have been identified and MLF assistance for projects for conversion to non-CFC technology was obtained for those eligible for such assistance. Only two projects remain ongoing and in one of these the "Refrigeration Part" involving CFC 12 consumption was already completed in 2000. These projects are expected to eliminate the remaining CFC consumption in the domestic refrigeration manufacturing sub-sector according to the following schedule:

Estimate of Trend in CFC Phase-out from Ongoing Projects (ODP tons)					
2001	2002	2003	2004	2005	Total
0	27.9	2.5	0	0	30.4

The estimated population of domestic refrigerators and freezers in the Brazilian market is now some 62 million units, of which some 55 million contain CFC 12 refrigerant representing a 'bank" of around 8,250 ODP tons of CFC 12.

While the consumption of CFC 12 for servicing domestic refrigerators and freezers in 2000 was circa 900 ODP tons, of this, only around 90 ODP tons (10%) was consumed by the 1,945 authorised workshops of the large manufacturers. The remainder was consumed by the 60,000 service mechanics operating in the informal domestic and commercial refrigeration service sectors.

The average CFC 12 charge weight per refrigerator is 0.150 Kg. The annual consumption of around 900 ODP tons for servicing is 11% of the installed charge of the existing population of 55 million CFC 12 based domestic refrigerators and freezers. However, this does not mean that 11% (6 million) of the population of domestic refrigerators and freezers are serviced annually, as it does not take into account losses, overfilling, and CFC 12 used for purging systems after repairs, etc.

Domestic refrigerators and freezers in Brazil have a life expectancy of at least 20 years. Large numbers of domestic refrigerators and freezers based on CFC 12 refrigerant were still being produced in Brazil in 1999. It is estimated that some 39 million (70%) of the existing population of 55 million CFC 12 based refrigerators and freezers date from 1987. In 2007, after Brazil phases-out virgin CFC consumption, there could be as many as 25 million CFC 12 based domestic refrigerators and freezers still operating that, under normal circumstances, would require charging with CFC 12 following repairs. It would be around 2019 before these refrigerators would have achieved their life expectancy.

Early retirement of these refrigerators and freezers can be avoided through a combination of better trained service mechanics with the right tools and equipment, the use of recovered and recycled CFC 12, and either conversion to a "drop-in" replacement refrigerant (e.g. R401A, R401B, R409A, or R413A) or retrofit to a zero-ODP refrigerant (R134a). Assistance to avoid the early retirement of these domestic refrigerators and freezers by way of the options mentioned is requested under this plan.

The proposed strategy for the domestic refrigeration service sector is summarised as follows:

Domestic Refrigeration Service Sector CFC Phase-out Strategy

- *Train & Certify Refrigeration Mechanics and Technicians in the Domestic Refrigeration Service Sector (Courses tailored to their normal activities covering domestic refrigerators, freezers, and other small hermetic refrigeration systems).*
- *Recover CFC 12 in all Equipment Repair Activities (Equipment to be provided to certified refrigeration mechanics and technicians after they have completed the training course).*
- *Replace CFC 12 after Repair with the Appropriate "Drop-in" Refrigerant (Compressor manufacturers have confirmed that this is technically feasible).*

- *Aggregate Recovered CFC 12 for "External" Recycling or Reclaim at Regional Centres.*
- *Inter-State Transport Regulations to be Amended to Facilitate the Recovered, Recycled, and Reclaimed CFC 12 to be Transported within, and between States as a Non-Hazardous Substance and without Hindrance.*

The Government will work together with industry associations and other stakeholders so as to guarantee maximum impact in reducing CFC consumption.

The Commercial Refrigeration Sector consumed the following quantities of CFCs in 2000:

Manufacturing	-	206 ODP tons of CFC 11
	-	129 ODP tons of CFC 12
Service	-	3,297 ODP tons of CFC 12

To date, the MLF has already approved 29 projects in the commercial refrigeration sector in Brazil. Many more enterprises have been identified as consuming CFCs in this sector and additional projects/assistance to phase-out remaining consumption of at least 70 ODP tons of CFC 11 and 72 ODP tons of CFC 12 are required.

Excluding 3 projects that were cancelled, 11 ongoing projects that address part, but not all, of the consumption of CFCs in the commercial refrigeration manufacturing sector and these projects are expected to eliminate a total of 193.2 ODP tons of CFC consumption according to the following schedule:

Estimate of Trend in CFC Phase-out from Ongoing Projects (ODP tons)					
2001	2002	2003	2004	2005	Total
59.0	27.9	62.0	44.3	0	193.2

The above projects include three projects to phase-out CFC consumption in the manufacture of refrigerated trucks and trailers.

With a large number of enterprises identified as still consuming CFCs, the proposed strategy for the commercial refrigeration manufacturing sector is summarised as follows:

Commercial Refrigeration Manufacturing CFC Phase-out Strategy

- *Identify All Remaining Enterprises in the Commercial Refrigeration Manufacturing Sector, and Confirm the CFC Consumption, and Eligibility for MLF Assistance.*
- *Advise the Enterprises of the Current Legislation, Available Alternative Technologies, and Develop New Investment Projects to Phase-out Remaining CFC Consumption at Eligible Enterprises by 01 January 2006.*
- *Monitor CFC Consumption in the Commercial Refrigeration Manufacturing Sector until Phase-out in 2006.*

The consumption of CFC 12 in 2000 for servicing all of the different types of commercial refrigeration equipment found in Brazil, including refrigerated transport, has been estimated as circa 3,300 ODP tons. This is consumed by the 60,000 service mechanics operating in the informal domestic and commercial refrigeration service sectors.

This consumption of 3,300 ODP tons of CFC 12 for servicing in 2000 represents replacement refrigerant charges when repairs involve a new compressor or other component, and refrigerant charge top-up due to leaks from poorly maintained equipment. The consumption as a percentage of the installed charge of the existing population of CFC 12 based equipment is high compared to Article 2 countries. This is the result of service and repair work carried out by mechanics that lack proper training and tools, the poor status of many installations, and the virtual absence of any recovery and recycling of CFC 12.

Commercial refrigeration systems and equipment in Brazil have a life expectancy of between 10 and 15 years. Large numbers of commercial refrigeration systems and equipment based on CFC 12 refrigerant were still being produced in Brazil in 1999, and even today there remains some small volume production based on CFC 12.

In 2007, after Brazil phases-out virgin CFC consumption, there will still then be a significant population of CFC 12 based commercial refrigeration systems and equipment in operation that, under normal circumstances, would require charging with CFC 12 following repairs. The majority of such commercial refrigeration systems and equipment would have been retired by 2014, with only a small number perhaps having useful lifetimes up to 2017.

This conclusion is based on the typical lifetimes of the installed systems and equipment in the commercial refrigeration sector. While the demand for CFC 12 should now start to start to decline, the rate of replacement of old equipment will be slowed by the adverse economic situation currently faced by the Brazilian industry, and the working life of existing equipment may be forcibly extended. This is a recipe for increased consumption of CFC 12 for servicing bearing in mind the existing state of the service sector.

Early retirement of the installed commercial refrigeration systems and equipment can also be avoided through a combination of better trained service mechanics with the right tools and equipment, the use of recovered and recycled CFC 12, and either conversion to a “drop-in” replacement refrigerant (e.g. R401A, R401B, R409A, or R413A) or retrofit to a zero-ODP refrigerant (R134a).

Assistance to avoid the early retirement of these commercial refrigeration systems and equipment by way of the options mentioned is requested under this plan.

The proposed strategy for the commercial refrigeration service sector is summarised as follows:

Commercial Refrigeration Service Sector CFC Phase-out Strategy

- *Train & Certify Refrigeration Mechanics and Technicians in the Commercial Refrigeration Service Sector (Courses tailored to their normal activities covering small hermetic refrigeration systems, medium condensing unit systems, large supermarket/cold store systems, and refrigerated transport systems).*
- *Recover CFC 12 in all Equipment Repair Activities (Equipment to be provided to certified refrigeration mechanics and technicians after they have completed the training course).*

- *Replace CFC 12 after Repair with the Appropriate "Drop-in" Refrigerant in all Hermetic Systems (Compressor manufacturers have confirmed that this is technically feasible).*
- *Replace CFC 12 after Repair with the Appropriate "Drop-in" Refrigerant where this is technically feasible, otherwise use Recycled CFC 12.*
- *Aggregate Recovered CFC 12 for "External" Recycling or Reclaim at Regional Centres.*
- *Inter-State Transport Regulations to be Amended to Facilitate the Recovered, Recycled, and Reclaimed CFC 12 to be Transported within, and between States as a Non-Hazardous Substance and without Hindrance.*
- *Incentive Payment Scheme for Equipment Replacement with non-CFC System for Large Capacity Systems with a large annual CFC consumption for Repair and Service.*

Due the similarities and synergy between the two sectors, It is proposed that this strategy for the commercial refrigeration service sector be implemented in conjunction with the proposed strategy for the domestic refrigeration service sector.

The MAC Sector consumed the following quantities of CFCs in 2000:

Service - 660 ODP tons of CFC 12

Brazil has received no assistance to date for projects in the MAC sector.

The Government strategy for the MAC manufacturing sector is already well defined under CONAMA Resolutions 13 (1995) and 267 (2000) in respect of new, domestic or imported, vehicles and it can be simply described as follows:

- CFC based MAC systems banned in all new vehicle models introduced after 01 January 1997;

- CFC based MAC systems banned in all new vehicles from 01 January 2001.

The installation of CFC based MAC systems in second-hand vehicles, or the replacement of CFC based MAC systems in vehicles where replacement is necessary due to vehicle damage or system failure, is also prohibited as of January 2001.

With new model vehicle MAC systems based on HFC 134a since 1997, and in all new vehicles since 2001, the consumption of CFC 12 is declining.

For as long as the cost of CFC 12 remains significantly lower than the cost of HFC 134a, there remains the risk of reverse retrofit of HFC 134a based MAC to CFC 12. There is some evidence of this practice of "topping up" of HFC 134a based MAC systems with CFC 12 in the Brazilian market, but the full extent is not known. To counter this, the Brazilian Government can propose legislation that will require that all vehicles manufactured from 01 January 2001 will not have their registrations renewed if their MAC system contains CFC as refrigerant. This will discourage reverse retrofit of HFC 134a based MAC and "topping up" with CFC 12 and help prevent the demand of CFC 12 in this sector from increasing.

The average life expectancy of vehicles is around 20 years, but as has already been described in Chapter 4, MAC is not considered as "essential" but more as a "luxury" in Brazil, and when MAC systems fail in older vehicles they may not be repaired. The number of CFC 12 based MAC systems are then expected to decrease quite rapidly, and very few would be expected to still be in operation by 2015.

However, unlike hermetic refrigeration systems, MAC systems typically require a replacement charge of refrigerant every 2 years. The major problem faced by the MAC service sector then is how to cope with the phase-out of virgin CFC phase-out in 2007 when there will still be a significant population of vehicles with MAC systems based on CFC 12 that require CFC 12 until the year 2015.

Noting the need for legislative action to prevent an increase in CFC 12 consumption in the MAC service sector due to reverse retrofits and "topping up" of HFC 134a systems with CFC 12, and the need to provide an ongoing supply of CFC 12 for the existing population of vehicles fitted with CFC 12 based MAC systems, there is then an urgent need to address the current levels of CFC 12 consumption in the MAC service sector.

Within the life span of a vehicle, vehicle owners may need to have their MAC "repaired", as distinct from the more usual "service". The relatively high costs of new HFC 134a MAC systems, and retrofit from CFC 12 MAC to HFC 134a MAC, are barriers to such conversions. It is expected therefore that most owners of vehicles with a CFC 12 MAC that decide to effect repairs will replace the old CFC 12 units with another new, or rebuilt, CFC 12 unit.

Considering the high cost of replacement, or retrofit of CFC 12 MAC systems to use HFC 134a, the non-eligibility of such retrofits for MLF assistance, and the limited commercialization of "drop-in" replacement refrigerants for MAC systems, MLF assistance is therefore requested to implement the following proposed strategy for the MAC service sector:

Mobile Air-conditioning (MAC) Service Sector CFC Phase-out Strategy

- *A Training Programme in Good Practice for MAC Service Mechanics (Courses tailored to their specific needs, focussed on the recovery and recycling of CFC 12, the need to check for leaks and cure all leaks whenever replacing, or "topping-up", a loss of CFC 12, the unacceptable practice of "topping-up" HFC 134a systems with CFC 12, and also including information on retrofit of CFC 12 MAC systems to use HFC 134a).*
- *Recovery & Recycling of CFC 12 in all MAC Service & Repair Activities (Equipment to be provided to selected MAC Service Centres after mechanics have completed the training course).*
- *Whenever Possible, Recycled CFC 12 to be used for All Re-charge and "Topping-up" of CFC 12 based MAC Systems.*
- *Whenever Possible, When CFC 12 MAC Systems Require Replacement, Replace with HFC 134a MAC Systems.*
- *Source Additional Recycled CFC 12 Requirements only from Approved Regional Recycling or Reclaim Centres.*
- *Inter-State Transport Regulations to be Amended to Facilitate the Transport of Recycled, CFC 12 within, and between States as a Non-Hazardous Substance and without Hindrance.*

The Centrifugal Chiller (Central Air-conditioning & Industrial Refrigeration) Service Sector) consumed the following quantities of CFCs in 2000:

Service	-	26 ODP tons of CFC 11
	-	60 ODP tons of CFC 12

Brazil has received no assistance to date for projects in the central air-conditioning or industrial refrigeration sector.

The CFCs consumed in the service of centrifugal chillers as indicated above is a best estimate from local industry experts. This is the best information available, as although there are only four suppliers of centrifugal chillers active in the Brazilian market, it has proved impossible to obtain data on the total inventory of centrifugal chillers in the country, the installed charge by refrigerant type, or the true consumption of CFCs for servicing.

The use of CFCs is confined to the large centrifugal chillers designed to use CFCs and that were installed pre-1993. New installations since the early 1990's have used centrifugal chillers based on HCFC 123, HFC 134a, or HCFC 22.

CONAMA Resolution 267 states that CFC 11 imports will only be permitted to supply the consumption of companies registered at the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) and that have projects for conversion to CFC-free technologies being implemented or that are about to submit proposals for this purpose for up to 12 months from the date of publication of this Resolution. It also stated that companies that use CFCs, particularly in the services sector, in an annual amount equal to or greater than two hundred kilos, must be registered at IBAMA within a period of twelve months from the date of publication of this Resolution.

There is clearly consumption of CFC 11 for service in the centrifugal chiller sector. This consumption is by end-users, but they are not the importers. These end-users in the centrifugal chiller sector have no conversion projects and it is not clear how their requirements for CFC 11 are being met, or will continue to be met, under the CONAMA Resolution. There may also be chiller end-users consuming less than 200 Kg/year that are not registered, and do not have to be registered with IBAMA.

While the wording of the CONAMA Resolution on the control of CFC 11 imports is open to interpretation as to when the import of CFC 11 will be terminated, the Government intention is to phase-out CFC 11 consumption by a ban on imports effective 01 January 2007.

CFC 11 and CFC 12 chillers have distinctly different characteristics that inherently affect the amount of CFCs consumed for service.

CFC 11 based chillers operate at low-pressure, with part of the system below atmospheric pressure. Leaks in this part of the system that are not detectable under normal operating conditions result in air ingress into the system. The air accumulates in the condenser, blanketing the condensing surface, which results in higher system pressure and reduced performance. CFC 11 chillers are therefore fitted with a means to purge this air to the atmosphere and thus restore the chiller performance. Clearly such purging also results in loss of CFC 11.

Traditionally with CFC 11 available at low prices, and poor system management, it was not uncommon for CFC 11 chillers to be operated with the purge valve permanently "cracked open", or for period excessive (maybe unnecessary) purging to be carried out. The system was then periodically "topped- up" with virgin CFC 11 to replace the CFC 11 lost in the purging process.

In recent years "Purge Capture Systems" were developed to capture as much as possible of the CFC 11 vented during the purging of air from CFC 11 based chillers. It is not known to what extent these purge capture systems have been adopted by end-users in Brazil.

Clearly after any repair on a CFC 11 chiller that involves intervention, the system should be pressurized and thoroughly checked for leaks before being put back in service. Again it is not know if this is common practice in Brazil, where it is believed that around 80% of building air-conditioning systems are serviced by third parties.

On the other hand, CFC 12 chillers operating at positive pressure can be readily checked for refrigerant leaks during operation and there is no possibility of air ingress, and hence no refrigerant purging. However, loss of refrigerant during repairs involving system intervention will need to be replaced. Again the extent to which CFC 12 based chillers are subject to leak checks during normal operation, or indeed following repair but before re-commissioning, is also not known.

With large refrigerant charges in excess of 300 Kg of both CFC 11 and CFC 12 it is clearly important that during all repairs involving system intervention the refrigerant charge should either be transferred into the system refrigerant "hold tank" where one is included, or the refrigerant charge should be recovered into external tanks, for recharge after repair. If there is reason to question the quality of the recovered CFC then clearly it must be cleaned up by on-site recycling, or replaced by virgin, reclaimed, or externally recycled CFCs. Recovered CFC adjudged unsuitable for recharge, or recycling on-site, should be recycled, or reclaimed, externally.

The Brazil Country Programme claims that recovery and reclamation is rarely practiced in the centrifugal chiller service sector.

The phase-out of CFC consumption in the centrifugal chiller sector is particularly difficult given the high cost of retrofit of CFC chillers to use a non-CFC refrigerant. The option of retrofit of older CFC 11 chillers based on hermetic compressors to use HCFC 123 is not a cost-effective option as the chillers would have to be rebuilt to accommodate the stronger solvent properties of HCFC 123, and the action on the compressor motor windings and system seals, etc.

The high cost of replacing existing CFC based chillers is another barrier to reducing CFC consumption.

A further survey of the sector is required to establish a detailed inventory of installed chillers by capacity, refrigerant type, age, and application, as well as the identities of the chiller owners. With this information the chiller owners can be made directly aware of the legislation that will phase-out all Annex A CFCs in 2007, and the need to take early action to reduce, and if possible eliminate, their dependence on CFC refrigerants. It will also provide the opportunity for direct discussion on the incentive payment part of the strategy for phasing-out CFC consumption in the chiller sector, and enable the most cost-effective options to be selected.

Faced with CFC phase-out in 2007 but given the need to prolong the useful lifetimes of as many as possible of the existing chillers, and to encourage as far as possible the retrofit and replacement of chillers to non-CFC systems, and to help reduce the economic impact of such actions on chiller end-users in Brazil, MLF assistance is therefore requested to implement the following proposed strategy for the centrifugal chiller service sector:

CFC 11 & CFC 12 Centrifugal Chiller Service Sector CFC Phase-out Strategy

- *Develop a Code of Good Practice in Chiller Servicing (Based on the ASHRAE Code and promoted by PROZON in conjunction with ABRAVA).*
- *A Training Programme in Good Practice for Chiller Service Mechanics based on the Code of Good Practice (Courses tailored to their specific needs, focussed on the recovery and recycling of CFCs, the need to check for leaks and cure all leaks after repair and before re-commissioning, and also including information on retrofit of CFC chillers to use non-CFC refrigerants).*

- *Recovery & Recycling of CFCs in all Chiller Service & Repair Activities (Equipment to be provided to major Chiller Service Companies after mechanics have completed the training course).*
- *Whenever Possible, Recycled CFCs to be used for All Re-charge and "Topping-up" of CFC based Chiller Systems, Sourcing Recycled CFC Requirements only from Approved Regional Recycling or Reclaim Centres.*
- *Incentive Payment Programme for Chiller Replacement or Retrofit to use non-CFC refrigerant based on proven high levels of CFC consumption and confirmed technical feasibility of System Retrofit. (Note: This National Plan does not cover the full resource needs for CFC Chiller Replacement)*
- *Inter-State Transport Regulations to be Amended to Facilitate the Transport of Recycled, CFCs within, and between States as a Non-Hazardous Substance and without Hindrance.*

The Aerosol Sector consumed the following quantities of CFCs in 2000, believed to be all for the manufacture of aerosol MDIs, predominately bronchodilator products for the treatment of asthma and chronic obstructive pulmonary disease (COPD).:

17 ODP tons of CFC 11
40 ODP tons of CFC 12
17 ODP tons of CFC 114

Although un-audited sales data are available to which estimates for production can be projected, a comprehensive survey of the sector is required to determine the products being produced, the identities of the producers and where products are being sourced. While it is believed that this consumption of Annex A CFCs is for the manufacture of MDIs, and it may therefore be classed as an "essential use" currently exempt from control under the Montreal Protocol, this needs to be confirmed. The scale of demand for MDIs in Brazil also needs to be determined and the relative contribution from locally manufactured products and imported producers needs to be clearly understood before any robust strategy for the sector can be developed.

Brazil recognizes that it needs to urgently address the strategy for this sector considering that:

- The production of high quality Annex A CFCs required for MDIs is expected to end in 2004, and
- The target date of 2005 adopted by Article 2. Countries for the transition to CFC-free MDIs.

Some non-CFC MDIs have already been registered in Brazil and released onto the market. Experience appears to be similar to European experiences whereby non-CFC MDIs have a different taste and a different cooling effect to the traditional CFC based product. However to date approximately 75M non-CFC MDIs are being used around the world (similar to the product launched in Brazil) and they have been well received.

While the introduction of the non-CFC MDIs can be expected to be driven principally by the corporate policies of the multinational MDI manufacturers, it is important that Brazilian Health and Environment Departments work together to establish criteria for the eventual phase out of CFC MDIs.

The Brazilian Government wishes to move forward in step with changes that have occurred globally. To achieve phase-out in this sector by 2005 the following actions are required:

- A detailed survey of the scale of local MDI manufacture and imports needs to be completed urgently and any eligible investment projects prepared and implemented as rapidly as possible;
- An awareness campaign needs to be developed to help educate medical doctors who are prescribing MDI products that the transition process will happen and the reasons why it is happening.

MLF assistance for these actions is requested under this plan.

The CFC solvents sub-sector consumed the following quantities of CFCs in 2000:

29 ODP tons of CFC 113

There are no ongoing projects involving CFC 113 consumption.

The reasons for the ongoing use of CFC 113 are not clear, and the identities of the remaining users, and the applications, need to be established. CONAMA Resolution 267 permits CFC imports for "essential uses", and such essential uses include "as an agent in chemical and analytical processes and as a reagent in scientific research" (such as laboratory uses). There are commercially available alternative technologies to replace CFC 113 and the remaining users need to be made aware of the replacement technologies, and the National legislation.

Only 3 investment projects were approved by the MLF for the CFC 113 solvents sub-sector in Brazil. Two of these involved resources totalling US$ 68,400 to eliminate 3.6 ODP tons of CFC 113. The third project involved the phase-out of 2.0 ODP tons of CFC 113 used in the cleaning of medical parts and 14 ODP tons of CFC 12 used as in sterilisation of medical parts. This project was cancelled, as the recipient enterprise was unable to proceed because the approved funding was insufficient and it had no access to supplementary funds.

A single project in the "Combined CFC 113 and TCA" sector was approved to phase-out the use of 7.8 ODP tons of CFC 113 and 4.8 ODP tons of TCA in vapour degreasers to clean parts at an aircraft manufacturer. The sum approved was US$ 308,215 (excluding Agency Support Costs), and this project was cancelled, not completed.

The average cost-effectiveness of the two completed investment projects in the CFC 113 solvents sub-sector was then 19 US$/Kg.

A further survey of the sector is required to determine the nature of the residual CFC 113 consumption, as well as the identities of the users. Conversion to non-CFC technologies needs to be implemented as rapidly as possible so that complete phase-out in the sector can be accomplished before 2005. There may be essential uses that should be exempt from the current legislation but they need to be identified and the proposed strategy and legislation may need adjustment.

It is not clear whether the ongoing consumption of CFC 113 represents consumption in full, or part, by the enterprises whose projects were cancelled. The consumption data provided by PROZON suggests that CFC 113 consumption in the solvents sector declined steadily from 1990 until 1997 since when it has levelled off at around 29 ODP tons per year.

MLF assistance is therefore requested to implement the following proposed strategy for the CFC 113 solvents sector:

CFC 113 Solvents Sector CFC Phase-out Strategy

- *Identify Remaining Consumers of CFC 113 and the Applications.*
- *Advise the Users of the Available Alternative Technologies, and Convert all Remaining Users to non-CFC Technologies by 01 January 2005.*
- *Amend Legislation to Limit the Import of CFC 113 for Essential Uses.*

The Sterilants Sector is not attributed specifically with any consumption of Annex A CFCs in 2000, or in earlier years.

CONAMA Resolution No. 13 of 13 December 1995 prohibited the use of Annex A Group I & II, and Annex B Group I, II, and III controlled substances for all uses as sterilants in new, domestic or imported, equipment, products, facilities and systems from 01 January 2001.

The ban on the use of Annex A Group I & II, and Annex B Group I, II, and III controlled substances for all sterilant uses was reinforced in CONAMA Resolution No. 267.

There are no ongoing projects related to CFC use in sterilisation activities. One project with a "Sterilants" component was approved by the MLF. This was a CFC 113 Solvents project BRA/SOL/18/INV/36 that was approved in May 1996. It included the consumption of 14 ODP tons of CFC 12 used in the sterilisation of intravenous tubes and catheters, blood oxygenators and containers, cannulas, anaesthesia instruments, and urology tubes. The enterprise concerned was to eliminate CFC 12 consumption by replacing existing equipment and converting to the use of an ethylene oxide/carbon dioxide sterilant mixture. The project was cancelled, as the enterprise was unable to proceed because the approved funding (US$ 317,492 excluding Agency Support Costs) was insufficient and it had no access to supplementary funds. The current status of this enterprise relating to CFC consumption is not presently known.

A survey needs to be undertaken to establish whether there is any continuing use of CFCs for sterilisation procedures in equipment, facilities and systems installed prior to 2001. This survey must include the enterprise in the cancelled project BRA/SOL/18/INV/36 that was using CFC 12 for sterilisation to establish if there is remaining CFC 12 consumption and to establish what assistance is required to eliminate it.

If ongoing CFC 12 consumption for sterilisation uses is identified, then an information campaign is necessary to inform all such medical facilities of possible CFC 12 shortages in the near term future, and the phase-out of CFC 12 consumption by 2007, as promulgated under CONAMA Resolution 267.

MLF assistance is therefore requested to implement the following proposed strategy for the Sterilants sector:

CFC 12 Sterilants Sector CFC Phase-out Strategy

- *Identify Remaining Consumers of CFC 12 in Sterilisation Applications.*
- *Advise these CFC 12 Users of the Current Legislation, Available Alternative Technologies, and the CFC 12 Phase-out Date of 01 January 2007.*
- *Convert all remaining users of CFC 12 for Sterilisation Applications by 2007.*

Under the proposed plan, Brazil will be able to meet its 50% CFC consumption reduction targets for Annex A CFCs as required by the Montreal Protocol in 2005. It can also achieve phase-out of Annex A CFCs by 2007, 3 years ahead of the Montreal Protocol scheduled date of 2010, with acceptable financial and economic impact for the country.

There will clearly be a demand for both CFC 11 and CFC 12 for the repair and service of systems and equipment in the refrigeration and air-conditioning sectors beyond 2007. This cannot be predicted at this time with a high degree of accuracy. The premature retirement of equipment in these sectors can however be avoided by the proposed CFC 12 recovery and recycling initiatives coupled with improved quality of work from the service technicians resulting from the proposed training programmes. The useful working life of other equipment in these sectors can be extended by converting the equipment to use alternative CFC-free refrigerants, and again through the proposed training programmes and related Government initiatives included in this plan, Brazil will have both infrastructure and service technicians that are capable of making such conversions.

To ensure that the phase-out of Annex A CFCs is achieved according to this National Phase-out Plan, the Government of Brazil, through CONAMA, undertakes to make all necessary revisions to existing legislation controlling the consumption of such substances, including the manufacture and import of products made with, containing, or intended to use, such products. The revisions to the current legislation will address exemptions for any specialised “essential uses” for Annex A and Annex B Group I CFCs for which no alternatives are currently available.

Table 5.1. CFC Phase-out by Ongoing and Newly Proposed Activities (ODP tons)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
CFC 11 (Demand)	**3,561**	**3,561**	**3,561**	**3,561**	**3,561**	**3,561**	**3,561**	**3,561**	**3,561**	**3,561**	**3,561**
Impact of Ongoing Phase-out Activities											
Completion of Ongoing Projects – Foam		0	657.1	914.5	1,218.5	2,946.4	3,207.2	3,207.2	3,207.2	3,207.2	3,207.2
Completion of Ongoing Projects – Comm. Ref.		0	38.1	63.8	113.6	135.7	135.7	135.7	135.7	135.7	135.7
Completion of Ongoing Projects – Dom. Ref.		0	0	27.9	28.7	28.7	28.7	28.7	28.7	28.7	28.7
Impact of New Phase-out Activities											
Investment Activities – Foam Sector		0	0	0	0	40	74	74	74	74	74
Investment Activities – Comm. Ref. Sector		0	0	0	0	20	70	70	70	70	70
Technical Assistance Activities – Aerosol Sector		0	0	0	0	0	17	17	17	17	17
Chiller R&R Project		0	0	2	4	5	5	6	6	6	6
Chiller Replacement/Retrofit		0	0	4	10	12	17	22	22	22	22
CFC 11 Reduction Schedule	**3,561**	**3,561**	**2,866**	**2,549**	**2,186**	**373**	**6**	**0**	**0**	**0**	**0**
CFC 12 (Demand)	**5,669**	**5,669**	**5,669**	**5,669**	**5,669**	**5,669**	**5,669**	**5,669**	**5,669**	**5,669**	**5,669**
Impact of Ongoing Phase-out Activities											
Completion of Ongoing Projects – Dom. Ref.		0	0	0	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Completion of Ongoing Projects – Comm. Ref.		0	20.9	23.1	35.3	57.5	57.5	57.5	57.5	57.5	57.5
Completion of Ongoing Projects – Foam		0	28.5	28.5	28.5	43.5	43.5	43.5	43.5	43.5	43.5
Pilot Project – Refrigeration Technician Training		0	0	2	4	4	4	4	4	4	4
Impact of New Phase-out Activities											
Investment Activities – Foam Sector		0	0	0	0	355	537	537	537	537	537
Investment Activities – Comm. Ref. Sector		0	0	0	0	72	72	72	72	72	72
Investment Activities – Sterilants Sector		0	0	0	14	25	25	25	25	25	25
Technical Assistance Activities – Aerosol Sector		0	0	0	0	0	40	40	40	40	40
Dom/Com Ref Training, Recovery, & R&R		0	0	80	200	250	300	320	320	320	320
Com Ref Incentive Payment Project		0	0	40	85	100	120	130	130	130	130
MAC R&R Project		0	0	0	0	140	182	182	182	182	182
Chiller R&R Project			0	5	10	12	16	18	18	18	18
Chiller Replacement/Retrofit		0	0	10	16	24	32	42	42	42	42
CONAMA Resolution 267 Contribution to balance		0	252	1,763	3,210	3,345	3,825	4,196	4,196	4,196	4,196
CFC 12 Reduction Schedule (Max Permitted)	**5,669**	**5,669**	**5,368**	**3,717**	**2,065**	**1,239**	**413**	**0**	**0**	**0**	**0**

CFC 113 (Demand)	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**
Impact of New Phase-out Activities											
Investment Activities – Solvent Sector		0	0	0	0	24	24	29	29	29	29
CFC 113 Reduction Schedule	**29**	**29**	**29**	**29**	**29**	**5**	**5**	**0**	**0**	**0**	**0**
CFC 114 (Demand)	**17**	**17**	**17**	**17**	**17**	**17**	**17**	**17**	**17**	**17**	**17**
Impact of New Phase-out Activities											
Technical Assistance Activities – Aerosol Sector		0	0	0	0	0	17	17	17	17	17
CFC 114 Reduction Schedule	**17**	**17**	**17**	**17**	**17**	**17**	**0**	**0**	**0**	**0**	**0**
CFC 115 (Demand)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table 5.2. CFC Phase-out Schedule based on Proposed Plan

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Phase-out Schedule for Brazil	9,276	9,276	8,280	6,312	4,297	1,634	424	0	0	0	0
Interim Reduction Targets for Brazil	10,521	10,521	10,521	10,521	10,521	5,261	5,261	1,578	1,578	1,578	0
Required Additional Phase-out Activities	-	-	-	-	-	-	-	-	-	-	-

Note: The tables are based on inclusion of the full impact of the reduction in CFC consumption only in the year following project completion etc.

CHAPTER 6 - ACTION PLAN

The action plan comprises activities to be carried out under the National CFC Phase-out Programme in order to enable Brazil to meet its obligations under the Montreal Protocol relating to CFC consumption in 2005, and to completely phase-out the use of Annex A CFCs in the country in 2007, 3 years ahead of the Montreal Protocol deadline, while reducing the economic impact of these actions on the country. The proposed plan entails investment, technical assistance, and regulatory actions for the aerosol, foam, refrigeration and air-conditioning, solvent, and sterilants sectors.

Actions in the refrigeration and air-conditioning sector represent the critical part of the plan in achieving the abovementioned goals, as this sector accounted for 5,312 ODP tons (57%) of total CFC consumption in 2000, while ongoing projects in the sector will eliminate only 223.6 ODP tons of this consumption.

PROZON will be the lead-executing agency of the action plan in close co-operation with other key agencies concerned, and with assistance from consultants. The action plan also includes a capacity building programme to ensure adequate capacity of the enterprises and the executing agencies. Detailed activities are discussed below.

1. AEROSOL SECTOR

Brazil has had legislation in place since 1988 that prohibits the use of CFCs as aerosol propellants except for use in medicines and pharmaceutical formulations for treatments in aerosol form, such as Metered Dose Inhalers (MDIs) and/or assembled in the form of a spray for nasal or oral use, such products being considered as “essential uses”.

In 2000 there was a total of 74 ODP tons of CFC 11, CFC 12, and CFC 114, being consumed by the aerosol sector. It is believed, but remains to be confirmed, that this is all for use in the manufacture of MDIs. This would suggest local manufacture of the order of 3.1 million MDIs/year.

Almost 97% of the locally produced MDIs are manufactured by a multinational enterprise that is not eligible for MLF assistance. Presently it is believed that one domestic manufacturer (Biosintetica) produces approximately 60,000 – 100,000 units per year of an inhaled corticosteroid (Budesonide). As this drug does not have a global replacement product, there is a need for further formulation efforts before phase out. This needs to be confirmed along with a complete understanding of the distribution between local manufacture, imports, and exports of MDIs, versus local demand.

1.1. INVESTMENT COMPONENT

A detailed survey of the scale of local MDI manufacture needs to be completed urgently to establish the identities of all the enterprises that may be eligible for MLF assistance to eliminate CFC consumption. The total consumption of CFCs by such enterprise(s) is clearly small (less than 4 tons/year) and relatively modest levels of investment are likely to be required to assist such enterprises. The actual levels of investment required to change the existing manufacturing processes cannot be determined until the MDI product reformulation needs of the enterprise(s) have been determined. For this reason, and assuming that there is at least one National MDI manufacturer eligible for MDI assistance, the anticipated funding has been included under the MLF funding requested for technical assistance to phase-out CFC consumption in this sector (see following section).

1.2. TECHNICAL ASSISTANCE COMPONENT

It is proposed that a CFC MDI phase-out strategy be developed. Even though the use of CFCs in MDIs is currently classified as an "essential use" by the Brazilian legislation, Brazil recognises the need to take proactive steps to eliminate such use, while at the same time ensuring the essential needs of dependent asthmas sufferers, and others with obstructive pulmonary disorders, are not jeopardised. The proposed date for phase-out of CFC use in MDIs is end-2005, and the need for such action is based on the following considerations:

The only remaining "essential use" involving production of significant quantities of CFCs is in MDIs. The only remaining significant production of the high quality CFCs required for MDI use is in the EU. There is Government pressure to stop production even for MDI use, and it is anticipated that production will cease by the end of 2004. There is likely to be stockpiling to meet demand for 2005, but not beyond.

Brazil needs to have a complete and detailed understanding of the supply and demand patterns relating to the use of MDIs in the country.

The non-CFC MDIs have a different taste and a different cooling effect from CFC MDIs. Physicians and patients therefore need to be aware of these changes (and the reasons for them) and be well prepared to accept them without the trauma likely from a sudden change from a familiar, to an unfamiliar, product. Experience (primarily in Europe) has indicated that rapid switching is the best approach to minimizing patient trauma.

The driving force for the introduction of the non-CFC alternatives will be strongly influenced by the corporate marketing and environmental policies of the multinational MDI manufacturers in Article 2 countries. However, the needs of Brazil's asthma sufferers have also to be fully taken into account.

The introduction of such important products as non-CFC MDIs needs to be managed and co-ordinated by the Government (particularly the Health and Environment Departments) working in close co-operation with producers, rather than the process being the sole preserve of the manufacturers. As such the Government wishes to begin the process by:

Ensuring that non-CFC MDIs meet all National Registration requirements well in advance of the proposed phase-out of CFC MDIs in 2005.

Educating medical doctors who are prescribing these MDIs about the changes in store, and the timing of the changes. While much of this education campaign can, and will, be paid for by the companies providing the alternative drugs, much will need to be done by the Government to avoid possible adverse health effects for the huge population of patients for whom such products are regarded as "life savers".

Based on these considerations, the Brazilian Government sees a need to develop a comprehensive strategy to phase-out CFC MDIs in Brazil in tandem with the anticipated transition to non-CFC MDIs in Article 2 countries in 2005.

Funding level. PROZON will work with the pharmaceutical industry to increase awareness of the affected population on the transition to non-CFC MDIs and to promote the use of CFC-free alternatives. PROZON will also work with the Ministry of Health and, where appropriate, suppliers to educate the medical doctors and to promote the use of CFC-free alternatives. The activities will be commenced as soon as possible. Financial support from the MLF is requested for the estimated costs of US$ 478,500 associated with this CFC MDI phase-out programme. (Table 6.1)

Table 6.1 Technical Assistance Component for MDIs

Description	US$
3 National Workshops	100,000
Consultant Fees	35,000
Information Dissemination Materials for Health Care Industry (assumes 20,000 physicians)	300,000
Sub-total	435,000
Contingency 10%	43,500
Total	**478,500**

In addition, there is a need for technical assistance for Biosintetica to help evaluate their MDI product formulation needs. A programme designed to establish what the technical limits of their MDI product needs are should start immediately and it is expected to take of the order of 4 – 6 months.

If Biosintetica can develop a successful non-CFC formulation that can be produced on a commercial scale it can be anticipated that there will be a need for production equipment changes to cope with the handling and filling HFC propellants in the absence of a liquid HFC replacement for CFC 11. Retrofitting of existing equipment will be carried out wherever possible. Assuming a maximum of two eligible enterprises, the following assistance for Biosintetica plus one additional enterprise is requested under this National CFC Phase-out Project (Table 6.2):

Table 6.2 Technical Assistance for National MDI Manufacturers (assumes 2 eligible enterprises)

Description	US$
Current MDI Product Formulation Evaluation & Assistance with Reformulation to a non-CFC Formulation	80,000
Production Equipment Changes to Manufacture non-CFC MDI Product (estimate)	800,000
Contingency 10%	80,000
Total	**960,000**

1.3. REGULATORY COMPONENT

In Brazil, the use of CFCs as aerosol propellants for non-medical aerosols was prohibited in 1988. This ban is maintained today in CONAMA Resolution No. 267 which prohibits the use of Annex A CFCs in any products used in the form of aerosols, except for medicinal purposes, in accordance to the following definition - “for medicinal purposes and

pharmaceutical formulations for medication in the form of aerosols, such as Metered Dose Inhalants and/or the like, in the form of sprays for nasal or oral use".

When the phase-out of CFCs in aerosols defined by the CONAMA Resolution as "essential uses" is achievable, then PROZON will amend the present regulations to prohibit the use of Annex A CFCs in all aerosol products, without exemption. The target date for completion of these activities is the end of 2005.

2. SOLVENTS SECTOR

CFC consumption in the solvents sector has almost been eliminated with only 29 ODP tons of CFC 113 remaining in 2000. The reasons for the ongoing use of CFC 113 are not clear, and the identities of the remaining users, and the applications, need to be established. There may be remaining uses that may be "essential uses" and as such they should be exempt from the legislation. There are commercially available alternative technologies to replace CFC 113 and the remaining users need to be made aware of the replacement technologies, and the National legislation.

In some countries where it remains legal to do so, enterprises continue to use CFC 113 as a solvent because it is cheaper than the alternative technologies, or because of concerns about the flammability, or toxicity, of the alternative solvents.

The solvent sector has a high proportion of SMEs and it is possible that the remaining consumption is by SMEs who are not aware of the legislation, or the alternative technologies. In this case, and if the uses are "non-essential" uses, then the phase-out of the remaining use of CFC 113 as a solvent will require a combination of regulations and financial assistance for those remaining enterprises that have not yet received assistance to convert.

The Government plans:

- To complete as a matter of priority, the identification of all remaining end-users of CFC 113;
- To phase-out the consumption of "non-essential uses" of CFC 113 as soon as possible, and by no later than the end of 2004;
- To provide assistance and encouragement to phase-out "essential uses" consumption of CFC 113 by conversion to alternative non-CFC technologies by no later than 2007;
- To review the status of all claimed "essential uses", and redefine "essential uses" as those for which currently no alternative technology is commercially available;
- To introduce a ban on the import of CFC 113 except for defined "essential uses" from 01 January 2005;
- To establish a maximum annual import quota of 5 tonnes of CFC 113 from 01 January 2005 strictly for defined "essential uses" which will decrease to zero in 2007.

These actions will phase-out all CFC 113 consumption in Brazil by the end of 2006.

2.1. INVESTMENT/TECHNICAL ASSISTANCE COMPONENT

A detailed survey of the remaining consumption of CFC 113 in the solvents sector is required to identify the consuming enterprises. It may be anticipated that the remaining consumption is mostly by SMEs and there could be a substantial number of such operations. In addition there may also be some consumption in Government Laboratories, Universities, by the police, etc. Assuming that the remaining consumers are eligible, it can be anticipated

that relatively modest levels of investment will be required to assist such enterprises to convert to non-CFC technologies. More substantive funding may be necessary to eliminate any "essential uses".

To phase out all uses of CFC 113 by the end of 2006, the remaining consumers of CFC 113 have to be identified, and a combination of assistance and new regulations will be required.

While the remaining enterprises have still to be identified, there remains consumption of 29 ODP tons/year of CFC 113 to be eliminated in the solvents sector. To achieve the phase-out of CFC 113, the Government plans to provide assistance to remaining eligible consumers to convert to non-CFC alternatives. The requested assistance from the MLF is US$ 551,000 that is based on the remaining consumption and the average cost-effectiveness of 19.0 US$/Kg for previously approved CFC 113 solvent sub-sector projects in Brazil.

Table 6.3 Requested Funding to eliminate remaining CFC 113 consumption in the Solvents Sector in Brazil

Remaining CFC 113 Consumption (ODP Tons)	Average CE Value CFC 113 Solvent Sub-sector Projects US$/Kg	Requested Funding (US$)
29	19.00	551,000

Resource will be required to identify the remaining enterprises, advise them on the alternative non-CFC/non-ODS solvent technologies, and to assist them in the conversion process. Depending on the number of enterprises involved and their location, workshop(s) on alternative non-CFC solvent cleaning technologies may be required. The costs of all these activities will be met from the requested funding for CFC 113 phase-out.

Funding mechanism. All identified users of CFC 113 in the solvent sector that are eligible, must submit information of their phase-out needs not later than the end of 2003. Proposals must include a list of new equipment items and safety devices, a specific completion date, and a plan and method to render the old equipment unusable. When converting to alternatives, enterprises are required to comply with other relevant environmental protection regulations in the country. All conversion must occur not later than **the end of 2006** .

2.2. REGULATORY COMPONENT

The Government will review the status of all claimed "essential uses" of CFC 113, and redefine "essential uses" as those for which currently no alternative technology is commercially available.

From 01 January 2005, the Government will prohibit the import of CFC 113 except for the "essential uses" as defined by Brazilian legislation, and establish a maximum annual import quota of 5 tonnes of CFC 113 strictly for the defined "essential uses" for 2005 and 2006. From 01 January 2007 the Government will prohibit the import of CFC 113.

A monitoring system will be established to monitor CFC 113 consumption for solvent applications until the phase-out of CFC 113 consumption in 2006 to ensure that there is no CFC 113 use resulting from illegal imports.

3. STERILANTS SECTOR

The most common use of CFCs in sterilisation activities is the use of mixtures of CFC 12 with ethylene oxide as the active sterilisation agent. CONAMA Resolution 267 prohibits the use of Annex A CFCs for all uses as sterilants in new, domestic or imported, equipment, products, facilities and systems from 01 January 2001. “New” is defined as post 01 January 2001. There are no controls on the ongoing use of Annex A CFCs in sterilisation activities involving pre-January 2001 equipment, products, facilities, and systems.

A CFC 113 Solvents project BRA/SOL/18/INV/36 was approved in May 1996 that included the consumption of 14 ODP tons of CFC 12 used in the sterilisation of intravenous tubes and catheters, blood oxygenators and containers, cannulas, anaesthesia instruments, and urology tubes. The enterprise concerned was to eliminate CFC 12 consumption by replacing existing equipment and converting to the use of an ethylene oxide/carbon dioxide sterilant mixture. The project was cancelled as the enterprise was unable to proceed as the approved funding (US$ 317,492 excluding Agency Support Costs) was insufficient and it had no access to supplementary funds.

The Government action plans for the sterilisation sector are:

- To establish the status of the enterprise that was using CFC 12 for sterilisation to see what assistance is required to eliminate any remaining CFC 12 consumption.

- To inform all medical facilities of possible future shortages of supply of CFCs, particularly CFC 12 if use in mixtures with ethylene oxide for sterilisation is identified.

- To complete as a matter of priority, the identification of all remaining end-users of CFC 12 for sterilisation applications;

- To provide assistance to phase-out the consumption of CFC 12 for sterilisation applications as soon as possible, and by no later than the end of 2006;

3.1. INVESTMENT/TECHNICAL ASSISTANCE COMPONENT

A survey needs to be undertaken to establish whether there is any continuing use of CFC 12 in medical facilities for sterilisation procedures. This survey must include the enterprise in the cancelled project BRA/SOL/18/INV/36 that was using CFC 12 for sterilisation to establish if there is remaining CFC 12 consumption and to establish what assistance is required to eliminate it.

If ongoing CFC 12 consumption for sterilisation uses is identified, then an information campaign is necessary to inform all such medical facilities of possible CFC 12 shortages in the near term future, and the phase-out of CFC 12 consumption by 2007, as promulgated under CONAMA Resolution 267.

To phase out all sterilants uses of CFC 12 by the end of 2006, all of the remaining consumers of CFC 12 have to be identified, and a combination of assistance to these remaining enterprises and the enforcement of existing regulations will be required. The requested assistance is therefore included in this section.

While the remaining enterprises have still to be identified, it is estimated that there may still be as much as 25 ODP tons/year of CFC 12 to be eliminated in the sterilants sector. The requested assistance from the MLF is US$ 600,000.

Table 6.4 Requested Funding to eliminate remaining CFC 12 consumption in the Sterilants Sector in Brazil

Remaining CFC 12 Consumption (estimated) (ODP Tons)	Requested Funding (US$)
25	600,000

Resource will be required to identify the remaining enterprises, advise them on the alternative non-CFC/non-ODS sterilisation technologies, and to assist them in the conversion process.

Funding mechanism. The Ozone Unit will invite all identified remaining users of CFC 12 for sterilisation applications to submit their applications for assistance to phase out CFC 12. All identified users of CFC 12 in the sterilisation sector that are eligible, must submit their phase-out proposals not later than the end of 2003. Proposals must include a list of new equipment items and safety devices, a specific completion date, and a plan and method to render the old equipment unusable. When converting to alternatives, enterprises are required to comply with other relevant environmental protection regulations in the country. All conversion projects must be completed by **the end of 2006**.

3.2. REGULATORY COMPONENT

The import quota system for CFC 12 in CONAMA Resolution No. 267 refers only to the control of imports of "CFC 12". As traditionally ethylene oxide/CFC 12 mixtures were marketed for sterilisation applications, then revision of the wording of the Resolution relating to CFC 12 imports will be considered to include "all mixtures containing CFC 12".

4. FOAM SECTOR

4.1. INVESTMENT COMPONENT

Recipients and funding level. According to CONAMA Resolution 267 and registration with IBAMA, and using information from chemical systems houses, and the Foam Industry Association (ABRIPUR), 170 companies and group projects (covering numerous very small enterprises) that meet criteria for MLF assistance were identified. While the identified enterprises may all be eligible for MLF funding, the EXCOM methodology used to establish the remaining consumption in the country does not give the balance to allocate ODP tons to the foam sector as to cover all the enterprises.

Table 6.5 Newly Identified Companies using CFC 11 in the foam sector

ENTERPRISE NAME	SUB-SECTOR
Con Sena	Rigid Foam (RPF)
Naturza	Rigid Foam (RPF)
Valerio Muller	Rigid Foam (RPF)
Pacifico	Rigid Foam (RPF)
Blue Wave	Rigid Foam (RPF)

RN	Rigid Foam (RPF)
Surf Radical	Rigid Foam (RPF)
Body Board	Rigid Foam (RPF)
Rip Fly	Rigid Foam (RPF)
Bel Wave	Rigid Foam (RPF)
Eugapec	Rigid Foam (RPF)
Politech	Rigid Foam (RPF)
Shintek	Rigid Foam (RPF)
RCD	Rigid Foam (RPF)
Politermica	Rigid Foam (RPF)
Aerojet	Rigid Foam (RPF)
Isotherm	Rigid Foam (RPF)
Libel	Rigid Foam (RPF)
Lothar	Rigid Foam (RPF)
Proquinor	Rigid Foam (RPF)
Induspol	Rigid Foam (RPF)
Base Ind. Reunidas Ltda	Rigid Foam (RPF)
Izomaquina	Rigid Foam (RPF)
Termisul	Rigid Foam (RPF)
Busscar	Rigid Foam (RPF)
Ciamont	Rigid Foam (RPF)
Termofibra	Rigid Foam (RPF)
Alvorada	Rigid Foam (TR)
Ibipora	Rigid Foam (TR)
Bonano do Brasil	Rigid Foam (RPF)
TR Group Project (15 enterprises)	Group Project – Rigid Foam
Fleck-Soft	Integral Skin Foam (ISF)
Sotan	Integral Skin Foam (ISF)
Poly U	Integral Skin Foam (ISF)
Therpan	Integral Skin Foam (ISF)
Sorriso do Lar	Flexible Foam (FPF)
Magnotron	Flexible Foam (FPF)
UltraFlex	Flexible Foam (FPF)
Colchonobre	Flexible Foam (FPF)
Pro-Rio/Terflex	Flexible Foam (FPF)
Colchoes Sao Jorge	Flexible Foam (FPF)
Reconflex	Flexible Foam (FPF)
Techfoam	Flexible Foam (FPF)
Bettanin	Flexible Foam (FPF)
Socimol	Flexible Foam (FPF)
Ronconi	Flexible Foam (FPF)
Apolospuma	Flexible Foam (FPF)
Esplanada	Flexible Foam (FPF)
Passalacqua	Flexible Foam (FPF)
Maso	Flexible Foam (FPF)
Nipobrasileira	Flexible Foam (FPF)
Paropas	Flexible Foam (FPF)
Pelmex	Flexible Foam (FPF)
Celuplas	Flexible Foam (FPF)
Soft-Spuma	Flexible Foam (FPF)
Stil	Flexible Foam (FPF)
Purcon (~200 enterprises)	Group Project – Flexible Foam

Polyurethane (~30 non –refrig enterprises)	Group Project – Multiple Subsectors
Tec Pur (~40 enterprises)	Group Project Multiple subsectors
Distributors of various systems houses	Group Project – Multiple subsectors
Mousseflex	Multiple Sub-sectors
Luguez	Multiple Sub-sectors
Ipla	PE
Movimax	PE

The Government plans to phase out the remaining consumption of CFC 11 and CFC-12 used by the eligible companies in the foam sector by converting all of them to non-CFC alternatives and would like to request funding of US$ 5,063,460 from the MLF. The funding level is calculated based on the remaining ODP tons allocated to the foam sub-sectors and the foam sub-sector cost-effectiveness thresholds. (Table 6.6).

Table 6.6 Requested Funding for Remaining Foam Enterprises for Brazil

Sector	ODP tons	Sub-sector CE Threshold (US$/kg ODP)	Funding Request (US$)
Rigid Polyurethane Foam (RPF)	10	7.83	78,300
Integral Skin Foam (ISF)	10	16.86	168,600
Flexible Polyurethane Foam (FPF)	34	6.23	211,820
Multiple Sub-sectors	20	9.53	190,600
PE/PS (CFC-12)	537	8.22	4,414,140
TOTAL	**611**		**5,063,460**

Funding mechanism

UNDP/PROZON will invite all eligible foam enterprises that are still using CFCs in their foam production to submit proposals for financial assistance for conversion to non-CFC alternatives. Very small enterprises will be included in lists of enterprises to be covered through systems houses and group projects. All proposals must provide information pertaining to non-CFC alternatives, baseline equipment, and equipment disposal plans. All proposals must have a conversion completion date no later than the end of 2005. Proposals must follow applicable MLF policies pertaining to equipment replacement, retrofit or purchase.

Enterprises will be invited to submit proposals to UNDP/PROZON not later than the end of 2003, to convert their existing facilities to CFC-free technology. Proposals must include a list of new and old equipment items and safety devices, if any, and a specific completion date that cannot be later than December 2005. The conversion plan must include a plan and method to render the old equipment unusable and a commitment to cease use of CFC 11 in the manufacturing process.

The project foresees phasing out the use of CFCs through a series of sub-projects for individual enterprises, as well as group projects covering smaller enterprises. The phase-out work will be coordinated through a local team who will oversee the project implementation, and work closely with PROZON and UNDP. The use of local expertise has been proven in previous group projects to be efficient and cost-effective. The action plan structure will include:

- Individual investment projects for enterprises with certified CFC consumption > 10 tons/y.
- Group investment projects for enterprises with certified CFC consumption between 1 and 10 tons/year.
- Technical assistance projects for enterprises with certified CFC consumption < 1 ton/y.

If additional eligible foam enterprises are identified during implementation, the costs of conversion at these additional enterprises will be covered by the funds already approved for this National CFC Phase-out Plan.

4.2. REGULATORY COMPONENT

Article 3 of CONAMA Resolution 267 permits the import of CFC 11 only for consumption by those companies registered with the Brazilian Federal Environmental Agency (IBAMA) with projects to convert to CFC-free technologies that are in the process of implementation or preparation.

It is proposed that the CONAMA Resolution No. 267 be amended to address these issues and to more effectively control CFC 11 imports by a series of better-defined annual import quotas. For example, these could be based starting 2003 on the eligible remaining CFC 11 consumption required for ongoing projects + 10%. For the years 2004, 2005, and 2006, the 2003 CFC 11 import quota could then be reduced annually by the amount of CFC 11 to be eliminated by ongoing projects scheduled for completion in 2003, 2004, and 2005, respectively. Such an amendment to CONAMA Resolution No. 267 would send a clearer signal to the industry that CFC 11 was to be phased-out by 01 January 2007, and it would also serve to ensure that ongoing projects were completed on time, thus assisting Brazil to meet it's Montreal Protocol obligations on CFC consumption.

The existing legislation will be enforced in harmony with the MLF phase-out efforts to assure that newly identified and approved projects as well as ongoing projects in the foam sector are allowed to proceed and be completed according to the guidelines of the MLF and approved implementation milestones. The target is to phase-out CFC 11 consumption in the foam manufacturing sector by the end of 2005.

5. REFRIGERATION SECTOR

5.1. DOMESTIC & COMMERCIAL REFRIGERATION MANUFACTURING SUB-SECTOR

In Brazil, all manufacturing facilities for domestic refrigerators and freezers have been identified and those eligible have received MLF assistance for conversion projects. Only two projects remain ongoing and in one of these the "Refrigeration Part" involving CFC 12 consumption was already completed in 2000. The remaining consumption is only 28.7 ODP tons of CFC 11 and 1.7 ODP tons of CFC 12. The larger of the two projects involving 27.9 ODP tons of CFC 11 will be completed during 2002, while the other one will involving a total of only 2.5 ODP tons of CFC 11 and CFC 12 will be completed in 2003.

A number of manufacturers and installers of new commercial refrigeration equipment and refrigerated transport equipment continue to use CFCs as the refrigerants, and some also consume CFC 11 in the production of PU foam for insulation. A number of ongoing projects address some, but not all, of this continuing consumption.

There are 11 ongoing projects in the commercial refrigeration manufacturing sector that will eliminate 135.7 ODP tons of CFC 11, 54.5 ODP tons of CFC 12, and 3.0 ODP tons of R502 progressively over the period 2001 through 2004.

In 1999, data from the NOU suggested that in the commercial refrigeration manufacturing sector there were some 219 SMEs still manufacturing stationary commercial refrigeration equipment and consuming 400 tonnes of CFCs while another 15 SMEs were also consuming an undefined quantity of CFCs in the transport refrigeration manufacturing sector. Since then the MLF has approved projects to phase-out 165.1 ODP tons of CFCs in 11 commercial refrigeration sector projects, and 659.7 ODP tons of CFC 11 in projects classified by the MLF as foam sector projects, but which include consumption classified by the country as commercial refrigeration or transport refrigeration sector consumption.

A large number of enterprises have recently been identified as still consuming CFCs in the commercial refrigeration manufacturing sector. CFC consumption data needs to be verified for some enterprises. The available data on CFC consumption shows that these companies are consuming at least 70 ODP tons of CFC 11 and 72 ODP tons of CFC 12. In addition to the enterprises listed in the following section, there are as many again identified, but without more specific information on production volume, CFC consumption, etc. (**Ref Annex 4**.)

A combination of assistance to these remaining enterprises that are eligible for MLF assistance, and enforcement of existing regulations will be required to phase-out all remaining consumption in this sector **by the end of 2006**.

5.1.1. INVESTMENT COMPONENT

Recipients and funding level. Information obtained from several industry sources during February 2002 resulted in the identification of 49 enterprises that are said to be still consuming CFCs in the manufacture of commercial refrigeration equipment. This is not a complete list of enterprises, there are others that have been identified but to date there is no data available on their CFC consumption. There may even be more enterprises consuming CFCs in this sector that remain to be identified.

Table 6.7 Enterprises Identified as Consuming CFCs in the Manufacture of Commercial Refrigeration Equipment – February 2002

Enterprise	CFC 11 (Tons)	CFC 12 (Tons)	Products/Avg. Charge	Production Volume using CFCs
Trikem	0	17.0	?	?
Latina	1.5	5.5	Water Coolers	110,000
Masterfrio Ind. e Com. de Refrigeracao Ltda.	1.68	3.02	Water Coolers/Com. Ref.	28,000
Asseptica	7.0	3.0	Com. Refrigerators	?
Portuense	6.8	3.0	Display Case 1 Kg	3,000
Ruche	6.6	3.0	Display Case 1 Kg	3,000
Brasfilter	0	2.9	Water Coolers	50,000
Zero Grau	0	2.5	Com. Refrigerators	?
Friomax	2.4	2.5	Display Case 1 Kg	2,500
Ornifrio Ltda	0.3	2.4	Display Case 0.8 Kg	3,000
Refripar Paranavai	4.8	2.4	Display Case 1 Kg	2,400
Everest Refrigeracao Ind. e Com. Ltda.	4.83	2.05	Ice Makers, etc	15,000
Uniklima	0	2.0	Com. Refrigerators	?
Aquagel Refrigeracao Ltda.	0	2.0	Beer Coolers 2 Kg	1,000
Seral	7.3	1.8	Large Supermarket Frz.	?
Eugapec	0	1.8	Milk Coolers 3 Kg	600
Plastic Plus	0.49	1.8	Water Coolers	36,000
Freezer Ltda.	3.8	1.6	Display Case 1 Kg	1,600

Bruning Compact	2.3	1.2	Com. Refrigerators	?
Packo	0.8	1.2	Milk Coolers	600
Maxifrio Blum.	1.2	0.9	Com. Refrigerators	
Serbran	0.25	0.9	Water Coolers	18,000
Auden	1.6	0.72	Com. Refrigerators	1,800
Maksel	1.0	0.6	Com. Refrigerators	?
Polar Refrigeracao Ltda	3.12	0.5	Display Case 1 Kg	500
Artinox Industria	0.96	0.5	Display Case 1 Kg	500
Satief	1.5	0.5	Com. Refrigerator 2 Kg	250
A.G. Rebello	1.4	0.5	Display Case 1 Kg	500
Ouro Frio	0.3	0.45	Com. Refrigerators	?
Servinox Ind e Com de Aco Inox Ltda	0.66	0.4	Display Case 1 Kg	400
Diana Ind e Com de Refrig Ltda	0.6	0.4	Display Case 1 Kg	400
Multifrio	0.62	0.4	Display Case 1 Kg	400
Kit Frigor	0.2	0.34	Com. Refrigerators	?
Topema	0.9	0.3	Com. Refrigerator 2 Kg	150
Cainco	0.8	0.3	Com. Refrigerator 2 Kg	150
Frioleite	0	0.3	Milk Coolers 3 Kg	100
Libell	0.08	0.3	Water Coolers 50 g	6,000
Interfrio	0.4	0.25	Display Case 1 Kg	250
Gelomax Ind Com Refrig Ltda	0.42	0.25	Display Case 1 Kg	250
Ind Com e Refrig Colatinensse Ltda	0.39	0.25	Display Case 1 Kg	250
Friodinal Ind e Com de Refrig Ltda	0.24	0.25	Display Case 1 Kg	250
Eco Equipamentos	0.55	0.2	Com. Refrigerator 2 Kg	100
Piovan	0.8	0.2	Comp. Air Dryers	300
Altari	1.2	0.2	Refrigerated Transport	?
Dinox	0.32	0.15	Display Case 1 Kg	150
Tedesco	0.3	0.1	Com. Refrigerator 2 Kg	50
Newmec	0.01	0.05	Water Coolers 50 g	1,000
Rearcon	0.01	0.05	Water Coolers 50 g	1,000
Sineilo Canovas	0.006	0.02	Water Coolers 50 g	400
Total	**70.436**	**72.95**		

To phase out the remaining amount of CFC in this sub-sector, the Government plans to provide assistance to these small companies to convert to non-CFC alternatives and would like to request a fund of US$ 2,159,820 from the MLF. Because of the large number of enterprises involved, the high probability that the final CFC 12 consumption will be much higher than indicated, and the further identification and validation work remaining, the funding level is calculated on the basis of the established commercial refrigeration sector cost-effectiveness threshold limit of 15.21 US$/Kg.

Table 6.8 Requested Funding to eliminate remaining ODS consumption in the Commercial Refrigeration & Refrigerated Transport Manufacturing Sectors in Brazil

Sector	CFC-11 (ODP Tons)	CFC-12 (ODP Tons)	Total Consumption (ODP Tons)	Sector CE Value US$/Kg	Requested Funding (US$)
Commercial Refrigeration Manufacturing	**70.0**	**72.0**	**142.0**	**15.21**	**2,159,820**

Funding mechanism. The NOU (PROZON) will conduct a survey of the identified enterprises in the above table, and to identify as many as possible of the remaining commercial refrigeration manufacturing enterprises consuming CFCs. The survey will verify CFC consumption and eligibility for MLF assistance, and promote awareness of the funding available to complete CFC phase-out in the sector. PROZON will then invite all eligible enterprises that are still using CFCs in their manufacturing activities to submit proposals for financial assistance for conversion to non-CFC alternatives. Enterprises must submit their proposals to PROZON not later than the end of 2003. All proposals must provide information pertaining to non-CFC alternatives, baseline equipment, and equipment disposal plans. All proposals must have conversion completion dates that are before **the end of 2006**.

PROZON will, through the use of National Experts/Consultants, also provide technical assistance to help the enterprises prepare their proposals. Proof of ODS consumption will be required, and the sector CE value will be applied to all proposals for funding assistance. If the identified consumption is greater than indicated in the above table then the eligible funds will first be pro-rated accordingly to cover as many enterprises as possible.

The resource required for verification of CFC consumption, eligibility for MLF assistance, to identify the remaining enterprises, to advise them on the alternative non-CFC technologies, and to assist them in preparing their applications for financial support to PROZON will be in the form of National Experts/Consultants. Depending on the number of enterprises involved and their location, workshop(s) on alternative non-CFC technologies may be required. The costs of all these activities will be met from the requested funding of US$ 2,159,820 for CFC phase-out in the commercial refrigeration manufacturing sector.

No additional funding for the commercial refrigeration manufacturing sector will be requested, but any surplus will be transferred to other parts of the National CFC Phase-out Plan that experiences shortfalls between the approved and required funding to complete phase-out. The reverse may be applied whereby when phase-out has been completed in other sectors, any surplus may be transferred to offset any shortfall in the commercial refrigeration manufacturing sector.

5.1.2. REGULATORY COMPONENT

Due to the need to provide assistance to the many SMEs that were not contemplated with MLF projects, from **01 January 2004**, the Government will monitor all enterprises that do not have ongoing projects, as well as the conversion process in ongoing projects so as to guarantee that no CFCs are used to manufacture new equipment and systems.

5.2. DOMESTIC & COMMERCIAL REFRIGERATION SERVICE SUB-SECTOR

The servicing of existing domestic refrigerators and CFC 12 based commercial refrigeration equipment is still carried out using virgin CFC 12, there is almost no recovery and recycling of CFC 12, substitution of CFC 12 by drop-in replacement refrigerants like R401A, R401B, R409A, or R413A, or retrofit to HFC 134a.

Most service technicians obtained their servicing skills through simple “on-the job” training with the result that many bad practices have been handed down and have become the norm. The two most common examples are the venting of the remaining charge of refrigerant, and failure to check for leaks following repairs.

Service technicians require different skills for servicing HFC 134a domestic refrigerators and commercial refrigeration equipment from those required for servicing CFC 12 based refrigerators, and specific knowledge and procedures to be able to replace CFC 12 with non-

CFC refrigerants. Such skills and knowledge are almost universally lacking in the service sector in Brazil.

The approach to reducing CFC consumption in the refrigeration and air-conditioning service sectors in other countries has historically been a combination of training service technicians in good practice and refrigerant conservation by recovery and recycling, and the provision of recovery and recycling equipment as part of a National refrigerant recovery and recycling programme. More recently, incentive programme projects have been approved for a small number of LVCs that are intended to reduce CFC consumption in the commercial and industrial refrigeration sectors by providing a small financial incentive to end-users to replace their existing refrigeration equipment with new CFC-free equipment, or to retrofit their existing CFC equipment to a zero-ODP refrigerant. While there is no experience to date from implementation of these incentive programme projects, they are considered a vital part of the eligible assistance available to developing countries to help achieve phase-out CFCs in the service sector.

To date, only very limited assistance has been provided to Brazil to address reduction of the high levels of CFC consumption in the refrigeration and air-conditioning service sectors. This assistance was in the form of two projects approved in 1992 and 1993, and one ongoing (approved in 2001) pilot training project for refrigeration service technicians (GTZ).

These projects have contributed little to reducing CFC 12 consumption in the service sector.

To contribute to any significant reduction in CFC 12 consumption in the period 2002 – 2004, the pilot training programme would need to be completed very rapidly, and then extended immediately into a full scale technician training and service tools/R&R equipment provision programme for the remaining technicians throughout the service sector.

The scale of CFC consumption in the refrigeration and air-conditioning service sectors, coupled with the size of the country, the geographical distribution of consumption, and the large number of SMEs and service technicians involved, means that while the traditional approaches referred to above must also be applied in Brazil, they must include more innovative measures to guarantee significant reductions in CFC consumption in the near future.

With most of the companies in the refrigeration service sector involved in the service of both domestic and commercial refrigeration equipment, it is not considered necessary to address the domestic refrigeration service sector separately from the commercial refrigeration sector. Similarly, because the use of CFCs to service refrigerated transport and for shipping containers is also very small, no specific assistance is proposed for these sectors, over and above that which is proposed for the sector as a whole. Only the chiller and MAC sectors have sufficiently different issues to warrant being treated separately. The MAC and chiller sectors are dealt with in the next section.

Consumption of CFC 12 for service in the domestic refrigeration sector in 2000 was circa 900 ODP tons, while for the commercial refrigeration sector it was estimated as 3,300 ODP tons. There was no reported consumption of CFC 11, or R502, in these sectors.

Domestic refrigerators in Brazil are considered to have a lifetime of at least 20 years. With the end of large-scale manufacture of CFC 12 based domestic refrigerators and freezers in late 1999, then it would be around 2019 before these refrigerators would have achieved their life expectancy.

Commercial refrigeration systems and equipment in Brazil have a life expectancy of between 10 and 15 years. Large numbers of commercial refrigeration systems and equipment based

on CFC 12 refrigerant were still being produced in Brazil in 1999, and even today there remains some small volume production based on CFC 12.

In 2007, after Brazil phases-out virgin CFC consumption, there will still then be a significant population of CFC 12 based commercial refrigeration systems and equipment in operation that, under normal circumstances, would require charging with CFC 12 following repairs. The majority of such commercial refrigeration systems and equipment would have been retired by 2014, with only a small number perhaps having useful lifetimes up to 2017.

This conclusion is based on the typical lifetimes of the installed systems and equipment in the commercial refrigeration sector. While the demand for CFC 12 should now start to decline, the rate of replacement of old equipment will be slowed by the adverse economic situation currently faced by the Brazilian industry, and the working life of existing equipment may be forcibly extended. This is a recipe for increased consumption of CFC 12 for servicing bearing in mind the existing state of the service sector.

The proposed strategy to eliminate CFC consumption in the domestic and commercial refrigeration service sectors is to provide service companies and mechanics with the knowledge, skills, and means, to manage the phase-out of CFC refrigerants and the transition to non-CFC refrigerants in the required timeframe. Financial assistance from the MLF is required to implement this strategy without significant adverse impact on the Brazilian economy.

5.2.1. TRAINING PROGRAMME FOR REFRIGERATION MECHANICS IN THE DOMESTIC & COMMERCIAL REFRIGERATION SERVICE SUB-SECTORS

This project is to train refrigeration mechanics and technicians, engaged in the installation and maintenance of domestic and commercial refrigeration systems and equipment throughout Brazil, in CFC management and conservation, including recovery, recycling, recharge, replacement refrigerants, retrofit refrigerants, and storage. This is necessary to reduce CFC consumption in the service sector, which is the largest remaining CFC consuming sector in Brazil. In order to be successful in reducing CFC consumption, some 60,000 refrigeration mechanics and technicians in the country need to be trained.

The project will be implemented through a total of 2,250 training courses organized throughout Brazil. The training programme will concentrate on the most essential service practices that are mainly responsible for the excessive consumption of CFCs. These practices are largely connected to the understanding and motivation of technicians. The activities of the project are designed in an integrated way and enhance a sustained change in behaviour and practices.

The training project is related to a separate investment project that will provide appropriate equipment to trained mechanics and technicians that will enable them to recover CFC 12 and replace it with non-CFC refrigerants in the course of their repair work on CFC based refrigeration systems. The courses will address related issues of environmental protection and specific legislation.

50 Trainers will be trained in this project. Those together with other experts in their institutions will responsible for the organization of 2500 training courses for refrigeration technicians and mechanics. In designing and implementing the training programme, full account will be taken of the experience gained from the ongoing Pilot Training Programme presently implemented by GTZ. The government of Brazil has requested the GTZ to assist in the implementation of the training project.

The total cost of this training programme project (*excluding Support Costs)* is US$ 5,968,790, and the budget details are as follows:

Item	No.	Cost per Item US$	Total Cost US$
International Expert	1	45,000	45,000
Train the Trainer Workshops	50	4,900	245,000
Technician Training Courses	2,500	1,998	4,995,000
Training Equipment			342,900
Promotional Start-up/ Workshop			193,000
Monitoring			113,600
Contingencies	10%		34,290
TOTAL COST			***5,968,790***
Support Costs	10%		596,879
COST (including Support Costs)			***6,565,669***

Details of the project are appended as **ATTACHMENT 1.**

5.2.2. CFC RECOVERY FROM DOMESTIC AND COMMERCIAL REFRIGERATION SYSTEMS AND EQUIPMENT DURING SERVICE & REPAIR ACTIVITIES

This project is to enable CFC 12 recovery throughout Brazil in order to decrease CFC 12 consumption during the service of domestic and commercial refrigeration equipment, (and to permit subsequent recycling, or reclaim, of the recovered CFC 12 at regional refrigerant recycle and reclaim centres that are the subject of a separate investment project within the overall Brazil National CFC Phase-out Project).

Refrigeration service mechanics will be trained in the training project (another separate project within the overall Brazil National CFC Phase-out Project) to perform recovery operations, recharging of serviced equipment using “drop-in” refrigerants, as well as retrofit of CFC 12 based equipment to use zero-ODP refrigerants.

This project will provide CFC 12 recovery and storage equipment to some 12,000 of the refrigeration mechanics that successfully complete the training programme for mechanics in the domestic and commercial refrigeration service sub-sectors. Mechanics will have to pay for the recovery and storage equipment using “*Certificates*” related to the value of the amounts of CFC 12 that they recover. This will result in reduced consumption of virgin CFC 12 in the refrigeration and air-conditioning service sectors, and assist Brazil in meeting its Montreal Protocol obligations and in achieving CFC 12 phase-out in 2007.

PROZON and UNDP, with the support of industry associations, will implement the project. A management structure will be established to supervise and monitor the project. The implementation of this project will be supported by specific legislation establishing the legal framework for the recovery recycling and reclaiming activities.

The total cost of this CFC 12 recovery project is US$ 6,520,800, and the budget details are as follows:

CFC 12 Recovery machines and components	
Investment Costs	
CFC 12 Recovery Machines	US$ 400 x 12,000= US$ 4,800,000
CFC 12 Storage Cylinders ***5 kg cylinders*** ***10 kg cylinders***	 US$ 37 x 12,000 = US$ 444,000 US$ 57 x 12,000= US$ 684,000
Sub-Total	**US$ 5,928,000**
Contingencies 10%	US$ 592,800
Total	**US$ 6,520,800**
Operational Costs	
Management (personnel, office materials, and others)	To be included in the management cost for the NPOP implementation
TOTAL COST	**US$ 6,520,800**

Details of the project are appended as **ATTACHMENT 2.**

5.2.3. ESTABLISHMENT OF REGIONAL CFC 12 REFRIGERANT RECYCLING AND RECLAMATION CENTRES IN BRAZIL

This project is to establish 10 regional CFC 12 recycle and reclaim centres in key locations in Brazils largest cities to enable CFC 12 recovered during the service and repair of domestic and commercial refrigeration equipment and systems to be recycled/reclaimed for re-use.

This will reduce virgin CFC 12 consumption in the refrigeration and air-conditioning service sectors, and assist Brazil in meeting its Montreal Protocol obligations and in achieving CFC phase-out in 2007.

The project is directly related to two other projects in the Brazil National CFC Phase-out Project: the Training Program for Refrigeration Mechanics in the Domestic and Commercial Refrigeration Service Sectors, and the Project for CFC Recovery from Domestic and Commercial refrigeration equipment and Systems during Service and Repair Activities. The training program will prepare the refrigeration mechanics for the activities involved in CFC 12 refrigerant management, including recovery, recycling, reclaiming, and the CFC Recovery project will provide equipment to enable the trained mechanics to practice CFC 12 Recovery.

A management structure will be established to supervise and monitor the project. The implementation of this project will be supported by specific legislation establishing the legal framework for the recovery, recycling and reclaiming activities.

The total cost of this regional CFC 12 recycle and reclaim project is US$ 3,880,000, and the budget details are as follows:

Regional CFC 12 Recycle/Reclaim Centres	
Investment Costs	
Processing Facility	US$ 350,000 x 10 = US$ 3,500,000
Contingencies 10%	US$ 350,000
Publicity Campaign	US$ 30,000
Sub-total	**US$ 3,880,000**
Operational Costs	
Management (personnel, office materials, and others)	To be included in the management cost for the NPOP implementation
TOTAL COST	**US$ 3,880,000**

Details of the project are appended as **ATTACHMENT 3.**

5.2.4. INCENTIVE PROGRAMME FOR THE COMMERCIAL REFRIGERATION END-USER SECTOR

The objective of this project is to eliminate CFC 12 consumption in the commercial refrigeration service sector by providing an incentive to end-user enterprises in the sector to encourage them to replace their existing CFC based refrigeration equipment with new equipment based on zero-ODP refrigerants, or to permanently retrofit their existing CFC based refrigeration equipment to use zero-ODP, or low-ODP refrigerants.

Incentive payments will be based on CFC consumption when equipment is replaced, or the cost of permanent retrofit & CFC consumption, and will range from US$ 400 - US$ 10,000.

The “Incentive Programme” will be publicized via National Workshops and by other means using ABRAVA, refrigeration equipment wholesales and distributors, equipment manufacturers, etc. Applications for the incentive payments will be sent to PROZON during the period 2003 - 2007.

PROZON will oversee this programme together with Agency assistance as required.

The total cost of this "Incentive Programme" project is US$ 4,180,000, and the budget details are as follows:

PROJECT BUDGET	US$
National Consultant to provide overall guidance, prepare materials and participate in workshops to publicise project, evaluate applications for incentive payments, follow up on these with the end-user enterprise, final inspections of completed works, certification of completion and destruction of replaced equipment, final review of documents and recommendations relating to the level of incentive payment, monitoring activities, etc. (4 years)	100,000
National Workshops for informing End-Users (5)	30,000
Local Travel within the country	40,000
Publicity materials and activities, documentation for applications, newspaper ads, etc.	10,000
Incentives to the End-Users	4,000,000
TOTAL COST	**4,180,000**

Details of the project are appended as **ATTACHMENT 4.**

5.2.5. Regulatory Component

The Government does not intend to use the mechanics training programme to introduce a formal accreditation or licensing scheme designed to limit access to refrigerants to licensed/certified technicians at this time. It considers that this would be logistically difficult and likely to promote a black market in CFC 12 (although the import quota system for CFC 12 could also lead to the same end result.

Regulations on the transport of hazardous substances, and the classification of recovered and recycled CFCs, apparently vary from State to State making for potential difficulties in the transportation of recovered, or recycled/reclaimed CFCs. The Government will review this situation and amend the State Transport Regulations to facilitate the transport of recovered, recycled, and reclaimed, CFC 12 within, and between States as a Non-Hazardous Substance and without hindrance.

5.3. MOBILE AIR-CONDITIONING (MAC) – MANUFACTURING SECTOR

The Government strategy for the MAC manufacturing sector is already well defined under CONAMA Resolutions 13 (1995) and 267 (2000) in respect of new, domestic or imported, vehicles and it can be simply described as follows:

- CFC based MAC systems banned in all new vehicle models introduced after 01 January 1997;
- CFC based MAC systems banned in all new vehicles from 01 January 2001.

The installation of CFC based MAC systems in second-hand vehicles, or the replacement of CFC based MAC systems in vehicles where replacement is necessary due to vehicle damage or system failure, is also prohibited as of January 2001.

5.4. MOBILE AIR-CONDITIONING (MAC) - SERVICE SUB-SECTOR

It is estimated that without any reverse retrofit of HFC 134a MAC systems to CFC 12, the current consumption of CFC 12 in the MAC service sector in 2000 was about 660 ODP tons.

With new model vehicle MAC systems based on HFC 134a since 1997, and in all new vehicle since 2001, the consumption of CFC 12 should then have been be starting to decline. However, there was no indication of such a decline in the consumption data to 2000.

For as long as the cost of CFC 12 remains significantly lower than the cost of HFC 134a, there remains the risk of reverse retrofit of HFC 134a based MAC to CFC 12. There is some evidence of this practice of "topping up" of HFC 134a based MAC systems with CFC 12 in the Brazilian market, but the full extent is not known.

The average life expectancy of vehicles is around 20 years, but as has already been described in Chapter 4, MAC is not considered as "essential" but more as a "luxury" in Brazil, and when MAC systems fail in older vehicles they may not be repaired. Notwithstanding this situation, it is expected that in 2010 there will still be a population of about 1.4 million vehicles in operation that were manufactured before 1997 and originally equipped with CFC 12 based MAC. This number is expected to decrease quite rapidly thereafter and very few would be expected to still be in operation by 2015.

With high rates of CFC replacement, and a significant population of vehicles with MAC systems based on CFC 12 that require CFC 12 until the year 2015. the MAC service sector needs a comprehensive CFC 12 recovery and recycling project to prolong the working life of the existing population of CFC 12 MAC systems without the need for costly retrofit. With import quota restrictions on CFC 12 already in place, and CFC 12 phase-out in 2007, this is required urgently.

5.4.1. NATIONAL PROGRAMME FOR RECOVERY AND RECYCLING OF CFC 12 REFRIGERANT IN MOBILE AIR CONDITIONING

This project is to implement a nation-wide CFC 12 Refrigerant Recovery and Recycling (R&R) Programme for the Mobile Air Conditioning (MAC) service sub-sector. With rapidly declining availability of CFC 12, this project aims to prolong the useful working lifetimes of CFC based MAC systems by eliminating the deliberate emissions of CFC 12 during MAC servicing through a comprehensive National MAC Recovery and Recycling Programme covering all private and public transport.

15 Training Workshops for MAC service technicians and mechanics will be held to familiarise them with the MAC R&R Programme and to train those provided with equipment, through the project, in the recovery and recycling of CFC 12 refrigerant during the service of MAC systems. The Workshops will emphasise the good practices needed in the handling of refrigerants during the servicing of MAC systems and the project will provide 450 MAC recovery/recycling machines and ancillary equipment to the selected enterprises in the MAC service sub-sector that consume CFC 12 refrigerant.
PROZON will oversee this programme together with Agency assistance and a National Consultant to monitor the quantity and quality of the CFC 12 recycled.

The total cost of this "Incentive Programme" project is US$ 1,976,400, and the budget details are as follows:

TRAINING SEMINARS	US$
One National R&R Expert & Lecturer	25,000.00
One National Consultant	5,000.00
One Administrative Assistant	2,500.00
Travel Expenses and DSA	20,000.00
15 Venues, Catering and Logistical Arrangements for the Seminars	9,750.00
Printing, Technical Material and Literature	2,400.00
Material for Participants and Practical Training	4,250.00
Equipment Transport	12,000.00
Sub-total	**80,900.00**
MAC CFC 12 RECOVERY AND RECYCLING EQUIPMENT	
450, MAC CFC 12 Recovery/Recycling Machines	1,305,000.00
450, MAC CFC 12 Recovery/Recycling Equipment Kits	117,000.00
450, 50lb. Recovery Cylinders with Two Ports, with OFP	45,000.00
Maintenance and Spares	40,500.00
Freight Costs	112,500.00
Contingencies (10% of the above)	162,000.00
Sub-total	**1,782,000.00**
MONITORING COSTS	
National Consultant (3 years)	90,000.00
Lap top Computer and Spread Sheet Soft Ware	2,500.00
Travel expenses and DSA (3 years)	12,500.00
Office Materials and Communication Expenses (3 years)	8,500.00
Sub-total	**113,500.00**
TOTAL PROJECT COSTS	**US$ 1,976,400.00**

Details of the project are appended as **ATTACHMENT 5.**

5.4.2. Regulatory Component

No immediate additional regulatory action is envisaged as necessary.

5.5. CENTRIFUGAL CHILLERS

Estimates based on surveys conducted for preparation of the National CFC Phase-out Project indicate that there are about 700 CFC based centrifugal chillers used in industrial process refrigeration and building air-conditioning. It is recognised that there may be a small number of chillers, especially older ones that have not been caught by the survey. The survey also indicated that some 28 tons of CFC 11 and 60 tons of CFC 12 were consumed in the servicing of these chillers during 2000. This includes the "top-up" of refrigerant losses during equipment operation, as well as the venting of all, or part, of the refrigerant charge during service and repair activities. The use of CFCs for the cleaning of systems during repair, as well as the overcharging of refrigerant, may also contribute to this consumption.

CFC chillers continued to be installed up until 1993. The majority of the existing chillers were installed in the late1980s and early 1990s. While there has been replacement of older CFC CFC chillers with non-CFC chillers during the past 8 years, this was because of the age of the chillers rather than for environmental reasons. Very few CFC chillers have been retrofitted to use non-CFC refrigerants. As the average lifetime of a chiller in Brazil is around 25 years, a substantial number of CFC chillers installed between 1982 and 1993 will still have remaining anticipated working lifetimes of between 1 to 11 years when CFCs are phased-out in Brazil in 2007.

Some CFC 11 chiller owners face chiller replacement because retrofit of their chillers to use HCFC 123 is technically difficult and it is not a cost-effective option. It may also not be cost-effective to retrofit older CFC 12 chillers. Chiller replacement is very costly, and even retrofit of those chillers that from a technical standpoint can be easily retrofitted from CFC 11 to HCFC 123, or from CFC 12 to HFC 134a, the costs involved are far from insignificant.

In order to reduce the economic impact of CFC phase-out, it is therefore important to take all possible measures to prolong the lifetime of the existing chillers and the strategy for that is based on the recovery and recycling of CFCs during service and repair operations. As replacement or retrofit must also be addressed, the additional elements of the strategy for the chiller sector are:

- An “Incentive Programme” for chiller replacement, or retrofit, to use non-CFC refrigerant based on proven high levels of CFC consumption and confirmed technical feasibility of system retrofit.

To implement these proposals a further survey of the sector is required to establish a detailed inventory of installed chillers by capacity, refrigerant type, age, and application, as well as the identities of the chiller owners. With this information the chiller owners can be made directly aware of the legislation that will phase-out all Annex A CFCs in 2007, and the need to take early action to reduce, and if possible eliminate, their dependence on CFC refrigerants. It will also provide the opportunity for direct discussion on the incentive payment part of the strategy for phasing-out CFC consumption in the chiller sector, and enable the most cost-effective options to be selected.

Brazil is therefore requesting MLF assistance to implement the above-mentioned strategies to reduce CFC consumption in the chiller service sector, and to reduce the financial impact on the chiller sector resulting from CFC phase-out.

Note: This National CFC Phase-out Plan does not address the total resource needs for CFC Chiller replacement.

5.5.1. CFC RECOVERY AND RECYCLING IN THE CENTRIFUGAL CHILLER SERVICE SECTOR

The principal objective of this project is to reduce the consumption of virgin CFCs in the service of centrifugal chillers employed in the air-conditioning and industrial refrigeration sectors. This project is to enable the recovery and recycling of CFC 11 and CFC 12 during service and repair of these centrifugal in order to prolong their useful working life and to avoid premature retirement. This action is essential because of enforced reductions in CFC consumption required before 2005, and the planned phase-out of CFC consumption in Brazil in 2007.

This project will provide two machines for CFC recovery and recycling, one for low-pressure refrigerant (CFC 11) and other for high-pressure (CFC 12), 15 maintenance and technical

assistance companies engaged in the servicing of centrifugal chillers. 10 refrigeration mechanics from each of these 15 companies engaged in the servicing of centrifugal chillers will also be trained at ABRAVA. The training courses will prepare the refrigeration mechanics for the activities of CFC recovery, recycling, and storage.

The training will also emphasize the essential need for CFC recycling, and will include information on the relevant environment regulations that already prohibit the venting of CFC refrigerants to atmosphere. A management structure will be established to supervise and monitor the project.

The total cost of this recovery and recycling project is US$ 1,163,670, and the budget details are as follows:

Investment Costs	US$
Recovery/Recycling Equipment CFC 11 equipment (York* model RSR-2212) CFC 12 equipment (York model RSR-2250)	 12,463 27,501
Storage Tanks CFC 11(York model RT-1600) CFC 11(York model RT-2222)	4,585 x 4 = 18,340 7,094 x 1 = 7,094
Leak Detectors	400 x 6 = 2,400
Contingencies (10%)	6,780
Training Courses	300 x 10 = 3,000
Sub-total	**77,578**
TOTAL COST (15 companies x US$ 77,578)	**1,163,670**

* Based on quotations from York International Corporation

Details of the project are appended as **ATTACHMENT 6.**

5.5.2. INCENTIVE PROGRAMME FOR REPLACEMENT, OR RETROFIT, OF CFC CHILLERS TO USE NON-CFC REFRIGERANTS

The objective of this project is to eliminate as much as possible of the CFC 11 and CFC 12 consumption in the centrifugal chiller service sector by providing an incentive to chiller owners to encourage them to replace their existing CFC based chillers with new chillers based on zero-ODP, or low-ODP, refrigerants, or to permanently retrofit their existing CFC based chillers to use zero-ODP, or low-ODP, refrigerants.
The Incentive is in the form of an *Incentive Payment* based on CFC consumption when a CFC based chiller is replaced, or the cost of permanent retrofit & CFC consumption when a CFC chiller is permanently retrofitted. The incentive payments will range from US$ 6,000 - US$ 18,000.

The “Incentive Programme” will be publicized via ABRAVA, and the local representatives of the chiller manufacturers. Applications for the incentive payments will be sent to PROZON during the period 2003 - 2007.

PROZON will oversee this programme together with Agency assistance as required.

The total cost of this “Incentive Programme” project is US$ 6,180,000, and the budget details are as follows:

PROJECT BUDGET	US$
National Consultant to provide overall guidance, prepare materials to publicise project, evaluate applications for incentive payments, follow up on these with the end-users, final inspections of completed works, certification of completion and destruction of replaced chillers, final review of documents and recommendations relating to the level of incentive payment, monitoring activities, etc. (4 years)	100,000
Local Travel within the country	40,000
Publicity materials and activities, documentation for applications, newspaper ads, etc.	6,000
Funding for Incentive Payments to the Chiller Owners	6,000,000
TOTAL COST	**6,146,000**

Details of the project are appended as **ATTACHMENT 7.**

5.5.3. Regulatory Component

There is consumption of CFC 11 for service in the centrifugal chiller sector. This consumption is by end-users, but they are not the importers. These end-users in the centrifugal chiller sector have no conversion projects and their requirements for CFC 11 under the CONAMA Resolution need to be addressed.

Considering that centrifugal chillers often have an anticipated lifetime of 25 years (chillers older than 30 years have been identified in Brazil) and that CFC based centrifugal chillers were still available until the early 1990's, then CONAMA Resolution 267 requires amendment to legally permit the import of CFC 11 for the service of centrifugal chillers at least until 01 January 2007.

6. CAPACITY BUILDING AND TECHNICAL ASSISTANCE ACTIVITIES

In addition to technical assistance activities that are sector-specific, it is proposed that two additional capacity building and technical assistance activities are included in the National CFC Phase-out plan. These are:

- Project Implementation and Monitoring Activity;
- Customs Training.

6.1. PROJECT IMPLEMENTATION AND MONITORING ACTIVITY

It is proposed that a project implementation and monitoring unit be established to provide the Government with necessary support to carry out all activities proposed under this plan. The National CFC Phase-out Plan entails CFC phase-out activities in the manufacturing sector, and training of a large number of small-scale and medium-scale service shops. In total, this overall plan will involve CFC phase-out activities in more than 50,000 private enterprises and government agencies, in addition to a series of activities to establish a policy and regulatory framework to support sustainable CFC phase-out.

Implementation of this proposed plan will involve a significant amount of administrative work to facilitate the development of the policy and regulatory framework, identification of

additional end-users, database of CFC users, development of enterprise-level project proposals, resource allocation for investment activities, public awareness activities, and other activities including necessary audit works. Implementation of this plan requires a project implementation and monitoring unit with full-time staff.

The following activities, but not limited to these activities, will be managed or carried out by the Project Implementation and Monitoring Unit:

6.1.1. Regulations

The project management team will assist PROZON to undertake the following:

- To develop a more specific import quota system and phase-out schedule for CFC 11(for chillers);
- To closely follow-up the CFC 12 import quota reduction schedule as defined in CONAMA Resolution 267 so as to guarantee compliance and measure market conditions and adequacy of supply;
- To monitor CFC 12 import licence quotas so as to safeguard the availability of CFC 12 according to the permitted import levels, and to provide adequate distribution of the quotas between major importers;
- To revise the CFC 12 import quota allocation system if necessary in order to permit transfers of unused quotas from one authorised importer to another on a quarterly basis;
- To attach a condition to all import licenses issued from 01 January 2003 onwards prohibiting the sales of CFC 11 for the use as a blowing agent to any enterprise in the foam sector that does not have an ongoing CFC phase-out project;
- To monitor the existing legislation on CFC 11 imports to guarantee the needs of CFC 11 imports for the service of CFC 11 based centrifugal chillers in the central air-conditioning and industrial refrigeration sectors;
- To monitor that imports of CFC 113, and CFC 114, as pure substances, and in mixtures, are only allowed to provide for the needs of any ongoing projects or essential uses until end of 2006;
- To prohibit the import of CFC 115 as a pure substance, and in mixtures such as R502, as there are no known ongoing needs for these substances;
- To prohibit the import of the substances known as "Other fully halogenated CFCs" (Annex B Group 1) in the Montreal Protocol of which there are small volume imports of CFC 211;
- To consider immediate prohibition on the import of disposable pressurised refrigerant containers;
- To enforce the existing prohibition on the use of CFCs in aerosol products except for recognised essential uses from 2003 onwards;
- To enforce all amended legislation on the import of all Annex A CFCs from 2003 onwards;
- To include pre-mixed CFC 11 polyol in the list of restricted products whose imports require review and approval from 2003 onwards;
- To issue a regulation or administrative order banning the use of CFC 113 in the manufacturing sector from 2005 onwards except for any quantities needed for "essential uses;
- To revise all Federal and State Transport legislation to permit the unhindered transportation of recovered and recycled CFCs between enterprises and regional CFC recycling/reclaim centres, and vice versa.

6.1.2. Project Implementation

The project management team will undertake the following activities:

- Prepare standard implementation procedures for eligible enterprises that would like to seek funding from the resources provided by the Multilateral Fund;
- Assist eligible CFC consuming enterprises prepare proposals to obtain financial support from the funds provided by the Multilateral Fund to phase out their use of CFCs;
- Arrange technical support, on a "as needs" basis, to assist enterprises to identify appropriate non-CFC technology;
- Review and approve proposals submitted by eligible enterprises;
- Co-ordinate the refrigeration technician training segments of projects proposed under this National CFC Phase-out Plan for the refrigeration and MAC service sectors;
- Facilitate the selection of qualified suppliers to supply tools and equipment for MAC and refrigeration servicing sectors to service shops;
- Develop and maintain a database of refrigeration and MAC certified technicians including names and addresses of service shops that already have their technicians trained;
- Assist PROZON in the implementation of the incentive payment projects for the commercial refrigeration and centrifugal chiller end-user sub-sectors proposed under this National CFC Phase-out Plan;
- Assist PROZON to establish its own independent monitoring and enforcement unit relating to CFC consumption;
- Prepare an annual progress report of the overall implementation of the National CFC phase out plan in accordance with any MLF ExCom procedures for this task;
- Investigate the possibility of imposing a duty of five or ten percent on the import of all CFCs to increase their market price and to provide an increased incentive for implementing border controls;
- Investigate options for using licence fees to raise revenue to assist with phase-out of CFCs in the service sector;

6.1.3. Public Awareness

The project management team will undertake the following tasks

- Disseminate information related to the Government's policy to phase out the import of all Annex A CFCs except for defined 'essential uses" with effect from 01 January 2007;
- Inform the different CFC consuming industry sectors of the availability of funds provided by the Multilateral Fund to support CFC phase out in Brazil;
- Raise public awareness of the environmental and economic impact of ozone layer depletion to the public via newsletters, news articles, seminars, radio spots;
- Organize a promotional programme to encourage the public to have their refrigeration and MAC systems repaired by certified technicians;
- Undertake public outreach programmes for the refrigeration and MAC servicing sectors as described in the previous sections.

6.1.4. Monitoring

The project management team will assist PROZON to carry out the following tasks:

- Set up a web site with a list of importers, their annual quotas, and the actual amount already imported within the current calendar year;
- Update the information on the actual amount of imported CFCs with the Custom Department on a quarterly basis;
- Monitor the import of HFC 134a, HCFC 22, and HCFC 141b;

- Train members of the proposed new PROZON independent monitoring and enforcement unit relating to CFC consumption to identify and monitor CFC use at the enterprise level;
- Train as appropriate, any PROZON State enforcement personnel to identify and monitor CFC use at the enterprise level;
- Inspect warehouses and storage facilities of CFC, HCFC, and HFC 134a importers;
- Report any incidents of illegal import of CFCs;
- Carry out safety and technical audits of all projects undertaken under this plan;
- Update the consumption data at the end-user level every year and prepare a revised strategy, if necessary, for PROZON;
- Prepare progress reports and annual work plans for submission to the MLF ExCom;
- Maintain good account of all the expenditure incurred by this project.

The total cost for the Project Implementation and Monitoring Unit project is US$ 2,695,000, and the budget details are as follows:

Description	US$
Regulatory and Policy Support	200,000
Project Implementation and Management (including experts' fees)	850,000
Public Awareness	800,000
Monitoring Activities	600,000
Sub-total	2,450,000
Contingency 10%	245,000
TOTAL	**2,695,000**

*After 2007, all remaining tasks will be carried out by PROZON

6.2. CUSTOMS TRAINING PROGRAMME

Brazil is now in the CFC consumption compliance phase of the Montreal Protocol and it must meet specific defined maximum annual levels of CFC consumption. In addition to its obligations under the Montreal Protocol to progressively reduce CFC consumption, it must also phase-out CFC consumption by 01 January 2010. However, the Brazilian Government had decided to accelerate the phase-out of CFC consumption by some three years to 01 January 2007.
Since Brazil stopped local production of CFCs in 1999, imports are now the sole source of CFCs. In addition to the local manufacture of CFC based products and equipment, Brazil also imports products and equipment that do, or could, contain CFCs. This equipment can be new and second hand. The monitoring and control of the import of bulk CFCs, mixtures of CFCs with other chemical substances, and products and equipment containing, or designed to contain or use CFCs, is then crucial to Brazil achieving its compliance targets on CFC consumption under the Montreal Protocol, and CFC phase-out on 01 January 2007.

Customs officers will be trained in proper checking, recognition, testing and monitoring of imports of CFCs. The training of customs officers follows closely the implementation of the regulation concerning CFCs consumption in the country. The statistical registration systems in Brazil need to be modernized in order to effectively identify CFCs in the specific categories like virgin CFCs, mixtures of CFCs with other chemical substances, CFC containing systems etc.

The total cost for the Customs Officer Training Project (*excluding Support Costs)* is US$ 225,200, and the budget details are as follows:

CUSTOMS OFFICER TRAINING PROJECT	
ITEM	**COST (US$)**
International Consultant:	
Customs Training Consultant	4,500
Registration System Update	1,350
Preparatory/Follow-up Training Officers	2,250
DSA Consultants	4,900
International Flights	7,000
Sub-total	***20,000***
Trainers	
Trainer Daily Allowance	24,000
Local Transport	18,000
Accommodation	7,200
Sub-total	***49,200***
Workshops	
Training Material	27,000
Workshop (Expenditures/Consumables)	10,000
CFC Identification Kits	90,000
Calibration of Testing Equipment at Exisiting Laboratory	10,000
National Expert/Coordinator	10,000
Sub-total	***147,000***
Component Total	***216,200***
Contingency	***9,000***
TOTAL COST	***225,200***
Support Costs	***29,276***
COST (including Support Costs)	***254,476***

CHAPTER 7 - JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

1. AEROSOLS

The following alternatives will be considered under this Plan:

Universally, hydrocarbons (propane/butane mixtures) are now the most widely used aerosol propellants to replace to CFC 12, CFC 12/11, and CFC 12/114 mixtures. Dimethyl ether (DME), compressed and dissolved gases such as nitrogen and carbon dioxide, as well as alternative packaging forms have also played a role in the replacement of CFCs as aerosol propellants.

The 1996 UNEP Technical Options Report on Aerosols Sterilants and Miscellaneous Uses and Carbon Tetrachloride approves the use of hydrocarbons as aerosol propellants.

The Brazilian Government introduced legislation to ban the use of CFCs as propellants in the manufacture of non-pharmaceutical aerosol products in 1998. Hydrocarbons also played a major part in the phase-out of CFCs as aerosol propellants in Brazil where the industry completed the conversion to non-CFC formulations in 1989.

The only permitted use of CFCs as a propellant was in the manufacture of pharmaceutical aerosol products such as metered dose inhalers (MDIs). This consumption continues today and CFC replacement in specialised pharmaceutical aerosol products such as MDIs has been achieved either by replacement by HFC 134a, or by other forms of dispensing packaging.

Replacement of CFCs in metered dose inhaler products requires extensive product development, testing, and certification by the relevant Health Authorities. Where HFC 134a is selected as the replacement propellant it must be high purity “pharmaceutical grade” HFC 134a.

2. FOAM

The presently available technologies to eliminate CFCs in the manufacture of *rigid polyurethane insulating foams* are:

CLASSIFICATION	LIQUID TECHNOLOGY	GAS TECHNOLOGY
LOW-ODP TECHNOLOGIES (“INTERIM”)	HCFC 141b HCFC 141b/22	HCFC 22, HCFC 142b HCFC 22/142b
ZERO-ODP TECHNOLOGIES (“PERMANENT”)	c-PENTANE, mixed PENTANES, WATER, HFC 365, HFC 245fa	HFC 134a

The selection of the alternative technology is governed by the following considerations:

a) Proven and reasonably mature technology
b) Cost effective conversion
c) Local availability of substitute, at acceptable pricing
d) Support from the local systems suppliers
e) Critical properties to be maintained in the end product
f) Meeting established standards on environment and safety

The following is a discussion of the mentioned technologies:

HCFC 141b has an ODP of 0.11. Its application is proven, mature, relatively cost-effective and systems that fit the enterprises' applications are locally available. HCFC 141b can, however, be destabilising in higher concentrations, being a strong solvent, which would lead to the need to increase the foam density. Being an interim option, its application would only be recommended if permanent options do not provide acceptable solutions.

HCFC 22 has an ODP of 0.05 and is under ambient conditions a gas. It is not offered in the applicable regional area as a premixed system and would require an on-site pre-mixer. It is not suitable for spray foam/slabstock applications. Its insulation value is somewhat less than with HCFC 141b.

HCFC 141b/HCFC 22 blends can reduce the solvent effect of HCFC 141b alone and therefore allow lower densities while maintaining acceptable insulation values. The blends are, however, not available in Brazil or neighbouring countries. On-site blending would significantly increase the one-time project costs. In addition, the technology is not proven for spray foam applications. Being an interim option, the same restrictions as for HCFC 141b would apply.

(cyclo-)PENTANE meets all selection criteria, except that of local availability. The use of hydrocarbons is a preferred solution when feasible from a safety and cost effectiveness standpoint. The relatively high investments for safety costs tend to limit pentane use to relatively large CFC users. In addition, the use of pentane is limited to those enterprises whose facilities can be adapted to meet safety requirements, and can be relied on to maintain safe operations. While it may be applicable, albeit connected with high investments and density limitations for the slabstock operation, it cannot be used, and never has been used, for (on-site) spray foam applications, where ever-changing ambient conditions never could provide for the required safety.

WATER-BASED systems are an alternative in cases where pentane is not feasible due to safety concerns, cost efficiency or availability. Water-based systems are, however, more expensive (up to 50%) than other CFC-free technologies due to reductions in insulation value (requiring larger thickness) and lower cell stability (requiring higher densities). They are also currently not available in the regional area. Water-based formulations tend to be most applicable in relatively less critical applications, such as in-situ foams and thermoware. In sprayfoam, while in principle feasible, it is reported that the current technology does not allow for overhead spraying and is therefore limited. For boxfoam, the technology is not applicable, as it would lead to an unacceptably high increase in the reaction temperature, leading to severe scorching and even spontaneous combustion.

LIQUID HFCs do not meet requirements on maturity and availability. However, trials show that systems based on these permanent options would be feasible in spray foam as well as slabstock.

HFC 134a is under ambient conditions a gas. It is not offered in the applicable regional area as a premixed system and would require an on-site pre-mixer. It is not suitable for spray foam applications. It is also less energy efficient, and expensive compared to most other technologies.

The following technologies have been considered for the *flexible polyurethane foam* conversion:

Until recently, the major CFC replacement technology in all flexible PU Boxfoam has been **methylene chloride (MC)**. To a certain extent, this conversion has been driven by

economics rather than environmental reasons. The use of MC is challenging for low density/supersoft formulations. Because of the higher level of tin catalyst, the foam feels rough and "dead" and control of the cell structure is more difficult ("pin holes").

Methylene chloride is a highly volatile substance with a relatively low acute toxicity. The volatility can trigger high concentrations in the air. Both the U.S. Environmental Protection Agency (US EPA) and the International Agency for Research on Cancer (IARC) classify the substance as a probable human carcinogen. The U.S. Occupational Safety and Health Administration has set an 8 hour time weighted average (TWA) level of *25* ppm for MC, although this is challenged by the industry as unjustifiably low. Most European countries enforce a 50 ppm TWA. Careful handling is of MC is required to avoid over-exposure of plant personnel. Examples of safety measures typically needed include:

- Proper encapsulation of the production units;
- Ventilation of production, curing and storage areas;
- Training of production personnel on proper handling and emergency response;
- Industrial hygienic monitoring.

Despite the industry's capability to handle MC in a safe way, more and more countries restrict the use of MC and force foam manufacturers to pursue alternative avenues.

Forced Cooling (FC) was proposed at times to reduce the exotherm and to avoid scorching, but its use posed a technological, procedural and environmental challenge. Its use has drastically decreased after public allegations in the USA of excessive isocyanate vapours.

The use of **liquid carbon dioxide ("LCD Technology"**) has not been introduced in box-foams. The technology requires a controlled decompression of the foam/LCD mixture that is difficult to realize in this application.

A long-standing co-technology is the so-called **"Low Index/Additive" (LIA) technology**. A lower isocyanate index reduces the exotherm and allows increased generation of chemical blowing agent (from water and TDI). The introduction of special additives stabilizes the foam that otherwise would not properly polymerise. In this way it is possible to replace CFCs to a large extent, but some auxiliary blowing agent is frequently still needed.

Another option is the use of **variable pressure technology**. It is well known that the blowing efficiency increases with decreased atmospheric pressure. This allows the manufacture of lower density foams at higher altitudes with less, or no, auxiliary blowing agent through a higher effectiveness of the water/TDI generated CO_2. This principle can be applied at lower altitudes by encapsulating the foam production line and then reducing process pressure. Conversely, the increase of pressure reduces the effectiveness of the water/TDI induced gas generation and in this way allows the generation of higher urea levels (a by-product of this reaction). This technology is marketed already many years for continuous operations under the name "VPF" Technology. Recently, the technology has successfully been applied to boxfoam by a variety of equipment manufacturers (Hennecke, Edge-Sweets, Fibras Alcala (Flex), and potentially Schmuzinger and OMS). The price for a complete unit currently varies between US$ 450,000 and 550,000, with other new companies still in development stage of equipment. There are no MLF projects yet approved based on this technology. The CFC threshold, taking into account expected Incremental Operating Benefits, would be ~ 60 t/y for full compensation. In Brazil, 5-7 units have been sold in the last two years, of which at least 3 are known to be installed and operating.

The prevailing auxiliary blowing agent in FPF in Brazil, a country with >200 boxfoam units and only 7 continuous foam lines, is MC. CFC 11 is used where MC does not perform (low

density supersoft foams and certain non-comfort applications) or when not available. MC is used in the purification of drugs and its use is by some authorities looked upon with suspicion and sometimes some times opposed. Some companies do not use MC because of its odour that is perceived adverse and persistent in their products, or from a standpoint of environmental stewardship. In such cases, companies use CFC 11 as long as possible. For them the use of variable pressure technology appears to be the only truly sustainable option but only feasible for relatively large enterprises.

The UNEP Foams Technical Options Committee has concern about the future transition step for SMEs in this sector and feels that a solution is required to prevent the extended use of CFC-based technologies.

Accepted ODS phase out technologies for *integral skin moulded foam* are:

CLASSIFICATION	LIQUID TECHNOLOGY	GAS TECHNOLOGY
LOW-ODP TECHNOLOGIES ("INTERIM")	HCFC 141b	HCFC 22
ZERO-ODP TECHNOLOGIES ("PERMANENT")	PENTANE ALL WATER BLOWN	HFC 134a

The selection of the alternative technology would be governed by the following consideration:

a) Proven and reasonably mature technology;
b) Cost effective conversion;
c) Local availability of substitute, at acceptable pricing;
d) Support from the local systems suppliers;
e) Critical properties to be maintained in the end product;
f) Meeting established standards on environment and safety.

HCFC 141b has an ODP of 0.11. Its application is proven, mature, relatively cost-effective and systems that fit the enterprise's applications are locally available. HCFC 141b can, however, be destabilizing in higher concentrations, being a strong solvent, which would lead to the need to increase the foam density. Being an interim option, its application would only be recommended if permanent options do not provide acceptable solutions.

HCFC 22 has an ODP of 0.05 and is under ambient conditions a gas. It is not offered in the applicable regional area as a premixed system and would require an on-site pre-mixer.

PENTANE is a technically feasible option, but is generally applicable only with enterprises that are large enough to warrant it from a cost and safety standpoint.

WATER-BLOWN foams use carbon dioxide as the blowing agent, which has no ODP, making water blown a favourable final solution. However, the skin formed is much thinner, and not always suitable, and there is an increased friability.

HFC 134a is under ambient conditions a gas. It is not offered in the applicable regional area as a premixed system and would require an on-site pre-mixer.

It should be noted that in some individual cases, methylene chloride has been utilized as an effective solution, but due to processing concerns, it cannot be seen as an overall permanent solution.

3. SOLVENT

Selection of alternatives to CFC 113 for the small remaining consumption of CFC 113 in the solvents sector will be determined during the implementation of the National CFC Phase out Plan. The report of the Solvents, Coatings, and Adhesives Technical Options Committee will be used for guidance in selecting alternatives. All proposed alternative technologies will be reviewed by the expert consultants assisting PROZON in project implementation before any project activities in this sector will be allowed to proceed. This is to ensure that all environmental, health, and safety requirements are adequately addressed.

4. COMMERCIAL REFRIGERATION

At the present time, the commercially developed options to replace CFC 12 refrigerant in commercial refrigeration equipment are limited to the following choices:

CLASSIFICATION	TECHNOLOGY
LOW-ODP TECHNOLOGIES ("INTERIM")	HCFC 22
ZERO-ODP TECHNOLOGIES ("PERMANENT")	HFC 134a, HFC Blends (R404A, R507) for low temperature applications, & Hydrocarbons (iso-butane, or propane/butane blends)

HFC 134a is non-flammable, it has no ODP, and the refrigeration system capacity and efficiency remain unchanged when an optimised compressor designed for HFC 134a duty is used. HFC 134a is therefore universally accepted as a CFC 12 replacement for commercial refrigerators and freezers. HFC 134a is widely available, the technology is mature and in use in most Developed Countries, as well as many Developing Countries. Replacement of CFC 12 by HFC 134a requires relatively modest changes to existing production facilities. These include a change of filter drier material, and appropriate measures to avoid moisture absorption by the synthetic polyol ester lubricant used in HFC 134a compressors. While HFC 134a does have a significant GWP, it nevertheless is considered as a "'permanent" long term replacement for CFC 12 as a refrigerant in commercial refrigeration applications.

HFC blends such as R404A or R507 are now also well established as replacements for CFC 12 in low temperature applications when replacement with HFC 134a cannot achieve the design operating temperatures. These HFC blends have similar properties to HFC 134a and replacement of CFC 12 by R404A or R507 requires similar, relatively modest, changes to existing production facilities as those required in a change to HFC 134a.

Another alternative to replacing CFC 12 in low temperature refrigeration applications is the use of HCFC 22. However, HCFC 22 has a small ODP, it is a controlled substance under the Montreal Protocol, and as such its use will eventually be phased-out. Therefore, HCFC 22 must be regarded as an "interim" solution that will require a change to an appropriate zero-ODP technology such as R404A or R507 at some future date. The advantages of HCFC 22 are that it is compatible with mineral oil and it has been widely used in the refrigeration industry for many years. System redesign will be involved in any conversion from CFC 12 to HCFC 22 in order to take into account the higher operating pressures and compressor discharge temperatures associated with HCFC 22.

Hydrocarbon refrigerants, both Iso-butane, and propane/butane mixtures, have been the choices of some enterprises, particularly in European countries for domestic refrigerators and some commercial refrigeration applications with small refrigerant charge sizes. The advantages of selecting a hydrocarbon refrigerant to replace CFC 12 are that the same CFC 12 compressors with mineral oil can be used, and the technology can be considered "permanent" as hydrocarbons have neither an ODP, nor GWP. However, there is a major disadvantage in that hydrocarbons are flammable. Whilst there is increasing interest in the use of this technology, it has found only limited acceptance in the USA because of safety concerns relating to the flammability of hydrocarbon refrigerants. The use of hydrocarbon refrigerants also will require some redesign of the equipment to ensure safe operation, and always requires extensive changes to existing CFC refrigerator manufacturing facilities to be enable flammable refrigerants to be safely stored and handled.

The transfer of hydrocarbon refrigerant technology to enterprises in Developing Countries requires the support of a technology partner experienced in the production of comparable refrigeration equipment using hydrocarbon refrigerants on a commercial scale. Hydrocarbon refrigerant technology may not then be a practical or cost effective option at many smaller scale enterprises due to the technology assistance and safety-related modifications required. Transfer of this technology also requires hydrocarbon refrigerant of the required quality that is not presently available locally in Brazil.

HFC 152a has also been considered as a candidate for CFC 12 replacement in domestic and commercial refrigeration equipment. However, HFC 152a is also flammable, the technology has not been developed commercially, and questions remain concerning it's stability in refrigerator systems. Furthermore, compressors for use with HFC 152a are not commercially available.

Taking all of the above factors into account, HFC 134a, or HFC blends, are the most appropriate choice to replace CFC 12 as the refrigerant in commercial refrigeration manufacturing operations at small and medium scale enterprises.

To replace CFC 11 as the blowing agent in the manufacture of PU insulation foam for commercial refrigeration equipment the same options apply as described in **2. FOAM** above for rigid PU foam. As the enterprises that are still using CFC technology are all SMEs, the most appropriate choice to replace CFC 11 as the blowing agent is HCFC 141b. Cyclo-pentane would have been ideal from an environmental point of view, but is rejected as uneconomical and impractical given the scope and nature of the operations at these enterprises. The Government of Brazil will review the use of HCFC during the implementation of this plan. If HCFC 141b is the only possible solution, the Government agrees not to seek further funding from the Multilateral Fund to switch to a non-ozone depleting technology, such as cyclo-pentane, in the future.

5. MOBILE AIR-CONDITIONING

HFC 134a is widely accepted among the automotive industry as the most viable alternative refrigerant for CFC 12 for use in MACs. HFC 134a is a zero ODP alternative.

6. GOVERNMENT'S STATEMENT ON THE USE OF HCFCS AS INTERIM SOLUTIONS

Brazil is fully aware of the MLF ExCom Decisions relating to CFC 11 replacement technology selection that "presume" against the use of HCFCs. However, such HCFC based technologies are not prohibited and may still be considered eligible for MLF assistance. PROZON will review the use of HCFCs during the implementation of this National CFC phase out plan. Brazil has a preference for non-ODS substances and will enforce the general policy whenever possible.

CHAPTER 8 - COSTS OF NATIONAL CFC PHASE OUT PLAN

Activities	No. of Enterprises	ODP tons	Total Costs US$	Amount Requested US$
Technical Assistance Component for the MDI sector			478,500	**478,500**
Technical Assistance/Investment Component for 2 National MDI Manufacturers	2	< 4.0	960,000	**960,000**
CFC-113 phase-out in the Solvents Sector	?	29.0	551,000	**551,000**
CFC-113 phase-out in the Sterilants Sector	?	25.0	600,000	**600,000**
CFC phase-out in the foam sector				
Rigid PU Foam	?	10.0	78,300	**78,300**
Integral Skin Foam	?	10.0	168,600	**168,600**
Flexible PU Foam	?	34.0	211,820	**211,820**
Multiple Sub-sector	?	20.0	190,600	**190,600**
PE/PS (CFC 12)	?	537.0	4,414,140	**4,414,140**
Total		611	5,063,460	**5,063,460**
CFC phase-out in the Commercial Refrigeration Manufacturing Sector	> 49	142	2,159,820	**2,159,820**
Domestic & Commercial Refrigeration Service Sector				
Technician Training Programme			5,968,790	**5,968,790**
CFC 12 Recovery Project			6,520,800	**6,520,800**
Regional CFC 12 Recycle/Reclaim centres			3,880,000	**3,880,000**
Total			16,369,590	**16,369,590**
Commercial Refrigeration End-user Incentive Payment Project			4,180,000	**4,180,000**
MAC Recovery & Recycling Project			1,976,400	**1,976,400**
Centrifugal Chiller Service Sector CFC Recovery & Recycling Project			1,163,670	**1,163,670**
Centrifugal Chiller End-User Incentive Payment Project			6,146,000	**6,146,000**
Project Implementation and Monitoring Unit			2,695,000	**2,695,000**
Customs Training Programme			225,200	**225,200**
Total			42,568,640 [1]	**42,568,640**

[1] Excluding all costs related to early retirement of existing CFC based equipment, and excluding all Agency Support Costs.

CHAPTER 9 - NATIONAL CFC PHASE-OUT SCHEDULE FOR BRAZIL

There is no longer local production of Annex A CFCs and the Government of Brazil already has legislation in place and in operation that includes an import quota system for CFC 12,but none for CFC 11, CFC 113, CFC 114, or CFC 115. The same legislation clearly states 01 January 2007 as the phase-out date for all CFC 12 imports except for defined “essential uses”.

The legislation on CFC 11 imports recognises the needs of most of the remaining users of CFC 11 and it provides for an orderly conversion from CFC 11 to non-CFC replacement technologies up to 2007. In contrast, the legislation on CFC 12 imports results in a very rapid decrease in CFC 12 availability This despite the fact that there are both ongoing projects, and new projects, in the commercial refrigeration manufacturing sector involving conversion from CFC 12 to non-CFC technologies, and huge consumption of CFC 12 in the refrigeration and air-conditioning service sectors.

This National CFC Phase-out Plan proposes a review of the current legislation as embodied in CONAMA Resolution 267 as needed to support the action plan.

CHAPTER 10 - IMPLEMENTATION AND MONITORING

1. INTRODUCTION

Presently, the "Brazilian National CFC phase-out plan" is effectively the Brazilian Government legislation in the form of CONAMA Resolution 267 of 14 September 2000. While there are some loopholes in this legislation this is considered to be due to faults in drafting the legislation rather than any lack of intent to regulate CFC uses and consumption, and it is the stated intention of the Brazilian Government to phase-out all but "essential uses" of Annex A CFCs by 01 January 2007 ***subject to receipt of the necessary financial assistance from the MLF and on time to address legislation needs***.

This National CFC Phase-out Project Proposal therefore employs strategies for the phase-out of the remaining consumption of all Annex A CFCs, in all sectors, based on the Brazilian Governments target of 01 January 2007, so as to minimize the financial impact of this ambitious objective on the country at both the industrial and consumer levels. The strategies employed involve investment and non-investment activities, including public awareness, as well as a combination of policy and regulatory support through revision of the existing legislation.

This National CFC Phase-out Project Proposal therefore proposes a review of the current legislation as embodied in CONAMA Resolution 267 to provide greater time and flexibility to both manufacturing enterprises and end-users to convert to non-CFC technologies, while at the same time ensuring compliance with the Montreal Protocol CFC Consumption Compliance target in 2005, and the Brazilian Government target of CFC phase-out on 01 January 2007.

Instead of the traditional approach used previously in Brazil, where enterprises were identified and individual projects or group projects were prepared for an enterprise, or group of enterprises. This National CFC Phase-out Project Proposal requires enterprises to be proactive and apply for funds based on rules and guidelines established as part of this programme, consistent with MLF funding principles.

To attain proactive participation from the industry, this National CFC Phase-out Proposal proposes to utilise various incentive structures, including financial and regulatory incentives. These incentive structures are designed with the aim of ensuring permanent and sustainable reductions in CFC consumption, compliance with the 2005 Montreal Protocol CFC consumption target, and CFC phase-out by 01 January 2007 as planned by the Brazilian Government. In addition, public awareness activities are also built into this National CFC Phase-out Project Proposal to ensure that both the industry and end-users are fully informed about plans to first reduce, and then phase-out, CFC consumption in Brazil, the short-term and long-term implications of the global CFC phase out efforts, and the possibility for obtaining financial assistance to cover part of the CFC phase-out costs.

It must also be noted that any measures to restrict the supply of CFCs simply by reductions in import quotas without assistance to reduce the demand in the service sector will have the following unacceptable consequences for Brazilian stakeholders:

- CFCs will be hoarded and the availability of CFCs in the market will be significantly less than the amount permitted by the import quotas.
- CFC prices will rise accordingly and by significant margins.
- End-users will have to retire and replace equipment before its anticipated useful lifetime.

- There will be consequential losses resulting from spoilage of perishable refrigerated goods when equipment cannot be rapidly repaired due to non-availability of CFCs.
- A black market in CFCs can be anticipated fuelled by illegal imports of CFCs.

Therefore actions are required immediately to address the growing consumption of CFCs in the refrigeration and air-conditioning service sectors, including measures to prevent back-conversion from CFC-free technology to CFCs during service operations. Some form of monitoring must also be considered to ensure that those enterprises in the manufacturing sector that have already converted to non-ODS technology do not revert to CFCs.

Although the remaining consumption of CFCs in the aerosol sector is for "essential" uses, there is a need to address ways of eliminating this 74 ODP tons of CFC consumption.

While in 1994 the solvents sector was the largest ODS consumption sector in Brazil, the reported consumption in 2000 has fallen to just some 29 ODP tons of CFC 113 (as already mentioned TCA consumption was phased-out in 2000). The remaining consumers need to be identified, and options to convert to CFC-free technologies should be evaluated.

The Brazilian Government policy is to continue its proactive measures to assist remaining CFC-consuming enterprises to convert to non-ODS technology and to provide technical assistance and promote awareness so that the negative economic impacts of CFC phase-out are minimised. To avoid market distortion, the Government will strengthen its monitoring and enforce existing legislation on the use of CFCs in all parts of the manufacturing sub-sectors as soon as possible. It will also introduce and adjust as needed, the legislation covering CFC consumption in the refrigeration and air-conditioning service sectors as soon as feasible following the completion of training programmes and the supply of equipment to service technicians.

To achieve significant and sustainable reductions in CFC consumption in the refrigeration and air-conditioning service sector, a series of investment and non-investment activities, which are necessary to change the behaviour of end-users and service technicians, will have to be implemented starting as soon as possible. The size of the country, the huge inventory of existing CFC based equipment, and the number of service technicians involved, means that actions will have to be implemented regionally. It is also recognized that these types of activities require a long lead time before substantial reduction of CFCs can be achieved.

This National CFC Phase-out Project Proposal sets out the steps needed in order that Brazil can meet these objectives.

2. NATIONAL IMPLEMENTATION AND FINANCING MODALITIES

The agreed implementation modalities for various sectors and sub-sectors are as follows:

2.1 FUNDING BASED ON (a) ESTABLISHED MLF SECTOR/SUB-SECTOR COST-EFFECTIVENESS LIMITS, or (b) APPLIED SUB-SECTOR COST-EFFECTIVENESS VALUE WHERE NONE HAS BEEN ESTABLISHED BY THE MLF

The following implementation and financing modalities will be applied to investment projects in the solvent (CFC 113), sterilant, commercial refrigeration, and foam sectors.

a) Advertising and promotion of the MLF funding and CFC phase-out programme will be done through Trade Associations, workshops, national newspapers and trade magazines, refrigeration equipment wholesalers and distributors, equipment

manufacturers, etc. Where workshops are deemed necessary, enterprises will be invited to attend the project preparation workshops. At these workshops, the project management unit (to be appointed by PROZON) will provide training to enterprises on how to prepare project proposals;

b) For enterprises that require technical assistance to identify suitable non-CFC alternatives, they should submit their request to PROZON. Sector experts will be hired as appropriates to assist these enterprises in selecting appropriate non-CFC technologies;
c) All enterprises are invited to submit requests for funding in line with the MLF guidelines (no production expansion nor technology upgrade, funding requests must exclude export components). Priority will be given to the most cost-effective proposals. In case, phase-out costs requested by enterprises exceed the funding approved by the MLF, funding will be capped at the average level of cost-effectiveness of previously MLF approved projects in respective sectors or sub-sectors. In case there are savings, the remaining funds will be used for financing additional enterprises that are not included in the sector/sub-sector plan, or it will be transferred to other sector/sub-sector plans where there is either a shortfall, or a need to accelerate project implementation;
d) Other than for projects related to "essential uses", enterprises are required to submit their proposals before the end of 2003;
e) Each enterprise is required to provide detailed information regarding baseline situation and CFC consumption. Before signing contracts, information provided by enterprises will be verified by the project management team.

2.2 INCENTIVE PAYMENT PROJECTS FOR REPLACEMENT OF CFC BASED REFRIGERATION EQUIPMENT WITH NEW EQUIPMENT USING NON-CFC REFRIGERANTS, OR RETROFIT OF CFC BASED REFRIGERATION EQUIPMENT TO USE A NON-CFC REFRIGERANT (COMMERCIAL REFRIGERATION & CENTRIFUGAL CHILLERS END-USER SECTORS)

The financing modality is based on an "Incentive Payment" that is related to the verified average annual CFC consumption during the previous 3 years. To receive the full incentive payment, an end-user enterprise must be able to demonstrate total costs for the conversion that exceed the incentive payment as calculated based on the CFC consumption. In the case that the total costs for the conversion are less than the incentive payment as calculated based on the CFC consumption, then the incentive payment to the enterprise will be limited to the verified eligible costs incurred in the conversion. Incentive payments will be approved on a first come, first served, basis. Full details are included in the attached project proposals.

Advertising and promotion of the "Incentive Payment" project programmes will be done through Trade Associations, workshops, national newspapers and trade magazines, refrigeration equipment wholesalers and distributors, equipment manufacturers, etc. Where workshops are deemed necessary, enterprises will be invited to attend the project preparation workshops. At these workshops, a National Consultant (to be appointed by PROZON) will provide assistance to end-users on how to prepare requests for an incentive payment, and the necessary supporting documentation required;

The Consultant will also review all applications for incentive payments and make recommendations on approval, or rejection, to PROZON;

In the case of "approved" applications, up to 40% of the "Incentive Payment" can be advanced to the end-user to facilitate project implementation;

The Consultant will monitor project implementation, certify project completion, review the project cost documentation submitted by the end-user, and make a recommendation to PROZON on the final eligible level of the "Incentive Payment";

In the case of "Incentive Payment" projects involving equipment replacement, the National Consultant will also certify destruction/disablement of the baseline equipment such that it is no longer capable of using CFCs.

2.3 TECHNICIAN TRAINING & CFC 12 RECOVERY EQUIPMENT PROVISION (DOMESTIC & COMMERCIAL REFRIGERATION SERVICE SECTORS)

a) Technicians will be encouraged to apply for the training and certification courses through the publicity campaign, and other forms like indication by companies (equipment manufacturers or end-users like supermarkets,), wholesalers mailing list, etc. Priority will be given to the refrigeration mechanics working as supervisors in maintenance and repairing shops. Considering that these professionals will share with their colleagues the knowledge and techniques obtained in the courses, this strategy, as mentioned above, aims to amplify the effects of the training activity.
b) The training programme intends to inform service shops of the need to phase-out CFCs, the future short term reduced availability of CFCs, the possibility that PROZON may restrict the sales of CFCs only to those who have been trained on proper handling of CFCs, etc.;
c) The training will focus on the need for management and containment of CFC 12 refrigerant, and the recovery of CFC 12 coupled with the replacement by a "drop-in" refrigerant whenever technically possible during equipment repair or service activities.
d) To qualify for receipt of CFC 12 recovery equipment service shops must have at least one of their technicians trained and certified at one of the training courses under the project. Training centres will provide a list of certified technicians to PROZON. PROZON will maintain a database of certified technicians and the service shops that they are associate with;

2.4 FULL GRANT FINANCING FOR TECHNICAL ASSISTANCE AND CAPACITY BUILDING COMPONENTS

This financing modality will be applied to technical assistance components such as the MDI aerosol CFC phase-out plan, capacity building components, such as train-the-trainer programmes, technical capacity building for monitoring and enforcement personnel, customs officer training, and other like activities.

3. IMPLEMENTATION SCHEDULE

Table 10.1. National CFC Phase-out Project Implementation Schedule

Task	2002				2003				2004				2005				2006				2007			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Technical Assistance for MDI Sector																								
(i) Selection of Consultant			X																					
(ii) Consultation Process				X	X																			
(iii) Implementation of MDI Strategy					X	X	X	X	X	X	X	X												
TA/Investment Projects for MDI Sector																								
(i) Selection of Consultant			X																					
(ii) Survey of Local MDI Manufacturers			X	X																				
(iii) Evaluation & Reformulation Process					X	X	X																	
(iv) Conversion to non-CFC MDIs								X	X	X	X	X												
Investment Project for CFC 113 Solvents																								
(i) Selection of Consultant					X																			
(ii) Identification of CFC 113 Users						X	X																	
(iii) Conversion Project Preparation							X	X	X															
(iv) Non-CFC Project Implementation								X	X	X	X	X	X	X	X	X								
Investment Project - Sterilants Sector																								
(i) Selection of Consultant			X																					
(ii) Identification of CFC 12 Sterilant Users				X	X																			
(iii) Conversion Project Preparation					X	X	X																	
(iv) Non-CFC Project Implementation							X	X	X	X	X	X	X	X	X	X								
Investment Projects - Foam Sector																								
(i) Confirmation of Consumption/Eligibility			X	X																				
(ii) Conversion Project Preparation				X	X	X																		
(iii) Non-CFC Project Implementation					X	X	X	X	X	X	X	X	X	X	X	X								
Investment Projects – Comm. Ref. Mfg.																								
(i) Selection of Consultant					X																			
(ii) Confirmation of Consumption/Eligibility						X	X	X																
(iii) Conversion Project Preparation							X	X	X	X														
(iv) Non-CFC Project Implementation									X	X	X	X	X	X	X	X	X	X	X	X				
Investment Project – MAC Service Sector																								
(i) Selection of Consultant					X																			
(ii) R&R Equipment Procurement						X	X	X																
(iii) Technician Training Programmes								X	X															
(iv) R&R Project Implementation									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Investment Project – Chiller R&R																								
(i) R&R Equipment Procurement				X	X	X																		
(ii) Technician Training Programmes						X	X																	
(iii) R&R Project Implementation							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Incentive Payment Project – Comm Ref.																								
(i) Selection of Consultant					X																			
(ii) Project Publicity/Workshops Activities						X	X	X																
(iii) Project Implementation								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Incentive Payment Project - Chillers																								
(i) Selection of Consultant					X																			
(ii) Project Publicity Activities						X	X	X																
(iii) Project Implementation								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Service Mechanics Training Course																								
(i) Development of Training Course			X	X	X																			
(ii) Equipment Procurement				X	X	X																		
(iii) Train the Trainer Programme					X	X	X																	
(iv) Service Mechanic Training						X	X	X	X	X	X	X	X	X	X	X								
Com Ref Service CFC Recovery Project																								
(i) Equipment Procurement			X	X	X	X																		
(ii) Project Implementation							X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Regional CFC Recycle/Reclaim Centres																								
(i) Equipment Procurement				X	X	X	X																	
(ii) Set-up of CFC Recycle/Reclaim Centres							X	X	X	X	X	X	X	X	X									
(iii) Project Implementation								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Customs Training Project																								
(i) Development of Training Course			X	X																				
(ii) Train the Trainer Programme					X	X																		
(iii) Equipment Procurement						X	X																	
(iv) Enforcement								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Project Management Unit																								
(i) Implementation Assistance			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(ii) NPOP Publicity Activities			X	X	X	X	X	X	X	X	X													
(iii) Public Awareness Activities			X	X	X																			
(iv) Legislation Revision/Regulatory Support			X	X	X	X	X	X	X	X	X	X	X	X	X	X								
(v) Monitoring & Enforcement						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
(vi) Activity Completed																								X*

*After 2007, all remaining tasks will be carried out by PROZON.

4. CASH-FLOW FOR THE NATIONAL CFC PHASE-OUT PLAN FOR BRAZIL

Table 10.2. Cash- flow for the National CFC Phase-out Plan for Brazil

Description	Total Request US$	2002	2003	2004	2005	2006	2007
Technical Assistance for MDIs	478,500	80,000	250,000	148,500			
Technical Assistance/Investment Projects (Max 2 National MDI Mfrs)	960,000	80,000	880,000	0			
Investment Projects - CFC 113 Solvents	551,000	0	351,000	200,000			
Investment Projects - CFC 12 Sterilants	600,000	60,000	540,000	0			
Investment Projects – Foam (all sub-sectors)	5,063,460	4,063,460	1,000,000	0			
Investment Projects - Comm. Refrigeration	2,159,820	0	1,559,820	600,000			
Investment Project – MAC R&R Project	1,976,400	0	1,976,400	0			
Investment Project - Centrifugal Chiller CFC R&R Project	1,163,670	863,670	300,000	0			
Commercial Refrigeration End-user Incentive Payment Project	4,180,000	40,000	1,140,000	3,000,000			
Centrifugal Chiller End-user Incentive Payment Project	6,146,000	600,000	1,146,000	4,400,000			
Domestic & Commercial Refrigeration Service Sector: • Technician Training Project • CFC 12 Recovery Project • Regional CFC 12 Recycle/Reclaim Project	 5,968,790 6,520,800 3,880,000	 1,940,000 2,520,000 400,000	 3,000,000 3,000,000 2,380,000	8,348,500 1,028,790 1,000,800 1,100,000			
Custom Training	225,200	60,000	165,200	0			
Project Implementation & Monitoring Unit	2,695,000	850,000	369,000	369,000	369,000	369,000	369,500
TOTAL	**42,568,640**	**11,557,130**	**18,057,420**	**11,847,090**	**369,000**	**369,000**	**369,000**

5. KEY PROJECT IMPLEMENTATION MILESTONES

Milestone	Performance Target	Amount (US$)
1st Tranche (2002)	The National CFC Phase-out Plan approved by ExCom.	**11,557,130**
2nd Tranche (2003)	Announcement of the National CFC Phase-out Plan; Revision of CONAMA Resolution 267 & Import Quotas in place for all Annex A CFCs from 2003 - 2007; Customs Officer Training completed; PROZON Monitoring & Enforcement Unit operational; Criteria and procedures for seeking financial support for foam investment projects completed & project implementation in progress at eligible enterprises; MDI Technical Assistance Projects Implementation in progress. 2002 PROGRESS REPORT SUBMITTED TO THE MLF	**18,057,420**
3 rd Tranche (2004)	Criteria and procedures for seeking financial support for solvent, commercial refrigeration, MAC & chiller investment projects completed & distributed & project implementation in progress at eligible enterprises; Refrigeration Technician Training Programme started; CFC 12 Recovery Equipment supplied to selected trained Technicians; one Regional CFC Recycling/Reclaim Centre operational. 2003 PROGRESS REPORT SUBMITTED TO THE MLF	**11,847,090**
4th Tranche (2005)	Refrigeration Technician Training Programme Completed; CFC 12 Recovery Equipment supplied to selected Technicians/Workshops; Regional CFC Recycling/Reclaim Centres operational; & Database of trained refrigeration service technicians is functional. 2004 PROGRESS REPORT SUBMITTED TO THE MLF	**369,000**
5th Tranche (2006)	All CFC phase-out activities in manufacturing sectors completed. CFC import in the previous year is within the limit proposed under the revision of CONAMA Resolution 267 and in compliance with the MP 50% Reduction target level. 2005 PROGRESS REPORT SUBMITTED TO THE MLF	**369,000**
6th Tranche (2007)	CFC Phase-out completed by 01 January 2007 as proposed under this plan. Ongoing administration of Incentive Payment Projects. 2006 PROGRESS REPORT SUBMITTED TO THE MLF	**369,000**
(2008)	2007 FINAL REPORT SUBMITTED TO THE MLF	**-**

ANNEXES

ANNEX 1. – CALCULATION OF REMAINING CFC CONSUMPTION ELIGIBLE FOR MLF FUNDING ACCORDING TO OPTION 2 OF DECISION 35/57

BRAZIL - FOAM SECTOR MLF INVESTMENT PROJECTS
(Data ex MLF Inventory)

APPROVED PROJECTS - SUMMARY OF FOAM SUB-SECTOR SUB-TOTALS & GRAND TOTAL (Excluding all CANCELLED Projects)					
	FOAM SUB-SECTOR	ODP tons to be Phased-out			Allocated Funds Excl. Support Costs US$
		Total	CFC 11	CFC 12	
Sub-total	RIGID FOAM	2,139	2,139	0	11,290,637
Sub-total	RIGID (INSULATION REFRIGERATION)	398.2	390.2	8.0	2,000,399
Sub-total	FLEXIBLE MOLDED	8.0	8.0	0	52,279
Sub-total	INTEGRAL SKIN	1,007.2	1,007.2	0	9,011,344
Sub-total	MULTIPLE SUB-SECTORS	615.3	615.3	0	3,795,148
Grand Total	**TOTAL PU FOAM SECTOR**	**4,167.7**	**4,159.7**	**8.0**	**26,149,807**
Sub-total	POLYSTYRENE/POLYETHYLENE	43.5	0	43.5	314,300
Grand Total	**TOTAL PU, PS, & PE FOAM SECTORS**	**4,211.2**	**4,159.7**	**51.5**	**26,464,107**

BRAZIL FOAM SECTOR - Total Ongoing Projects [1 & 2]			
FOAM SUB-SECTOR	ODP tons to be Phased-out		
	Total	CFC 11	CFC 12
RIGID FOAM	1,447.0	1,447.0	0
RIGID (INSULATION REFRIGERATION)	0	0	0
FLEXIBLE MOLDED	8.0	8.0	0
INTEGRAL SKIN	535.8	535.8	0
MULTIPLE SUB-SECTORS	571.3	571.3	0
POLYSTYRENE/POLYETHYLENE	43.5	0	43.5
TOTAL	**2,605.6**	**2,562.1**	**43.5**

Notes:

Compiled from MLF Inventory of Approved Projects "As of December 2000".

The "ONGOING" projects at GRUPO ACO, and EPEX, and the RONDOFRIO part of the 9 trucks group project (BRA/FOAM/34/INV/235) were cancelled during 2001 and they have been excluded from the list of ongoing projects in calculating the impact of "ONGOING" projects.

BRAZIL – REFRIGERATION SECTOR MLF INVESTMENT PROJECTS
(Data ex MLF Inventory)

APPROVED PROJECTS - SUMMARY OF REFRIGERATION SUB-SECTOR SUB-TOTALS & GRAND TOTAL (Excluding all CANCELLED Projects)						
	REFRIGERATION SUB-SECTOR	ODP tons to be Phased-out				Allocated Funds Excl. Support Costs US$
		Total	CFC 11	CFC 12	R502	
Sub-total	Domestic Refrigeration	1,636.2	1,002.4	633.8	0	7,831,702
Sub-total	Commercial Refrigeration	753.6	536.1	213.7	3.8	9,171,065
Grand Total	**TOTAL** REFRIGERATION **SECTOR**	**2,389.8**	**1,538.5**	**847.5**	**3.8**	**17,002,767**

BRAZIL REFRIGERATION SECTOR - Total Ongoing Projects [1 & 2]				
REFRIGERATION SUB-SECTOR	ODP tons to be Phased-out			
	Total	CFC 11	CFC 12	R502
Domestic Refrigeration	38.5	28.7	1.7	0
Commercial Refrigeration	193.2	135.7	54.5	3.0
TOTAL	**223.6**	**164.4**	**56.2**	**3.0**

Notes:

Compiled from MLF Inventory of Approved Projects "As of December 2000".

The "ONGOING" projects at RUBRA, and PANAMENTE REFRIGERACAO, were cancelled during 2001 and they have been excluded from the list of ongoing projects in calculating the impact of "ONGOING" projects, as has the impact of 8.1 ODP tons of CFC 12 resulting from **completion of the "Refrigeration Part" of the METALURGICA VENAN Project BRA/REF/28/INV/132.**

BRAZIL – CFCs to be Phased-out by Ongoing Projects (ODP Tons)

CFCs to be Phased-out by Ongoing Projects (ODP Tons)						
	CFC 11	CFC 12	CFC 113	CFC 114	CFC 115	Total
Rigid Foam	1,447.0	0	0	0	0	1,447.0
Rigid (Insulation Refrigeration)	0	0	0	0	0	0
Flexible Molded	8.0	0	0	0	0	8.0
Integral Skin	535.8	0	0	0	0	535.8
Multiple Sub-sectors	571.3	0	0	0	0	571.3
Polystyrene/Polyethylene foam	0	43.5	0	0	0	43.5
Domestic Refrigeration	28.7	1.7	0	0	0	30.4
Commercial Refrigeration	135.7	54.5	0	0	3.0	193.2
TOTAL	**2,726.5**	**99.7**	**0**	**0**	**3**	**2,829.2**
New Foam Projects March 2002	645.1	0	0	0	0	645.1
GRAND TOTAL	**3,371.6**	**99.7**	**0**	**0**	**3**	**3,474.3**

Remaining CFC Consumption Eligible for MLF Funding (Decision 35/57)

Remaining CFC Consumption Eligible for MLF Funding based on Decision 35/57 (ODP Tons)						
	CFC 11	CFC 12	CFC 113	CFC 114	CFC 115	Total
2000 Consumption	3,560.97	5,668.696	28.848	16.52	0.018	9,275.052
CFCs to be Phased-out by Ongoing Projects	2,726.5	99.7	0	0	3	2,829.2
Remaining CFC Consumption Eligible for MLF Funding	**834.47**	**5,568.996**	**28.848**	**16.52**	**(-2.982)**	**6,445.852**
CFCs to be Phased-out by New Projects approved in March 2002	645.1	0	0	0	0	645.1
Remaining CFC Consumption Eligible for MLF Funding	**189.37**	**5,568.996**	**28.848**	**16.52**	**(-2.982)**	**5,800.752**

ANNEX 2. - LIST OF CFC IMPORTERS

No.	Names of Importers
1	Du Pont do Brasil
2	Progen
3	Hoechst do Brasil Quimica e Farmaceutica
4	Frigelar
5	Atofina Brasil Quimica
6	Autotherm
7	Helcor
8	Quimicamar
9	Chemical Specialties
10	Genarex
11	VMC
12	Ambient Air
13	Recrusul
14	Athenas
15	Senter
16	Springer

Annex 3.

PROGRESS OF IMPLEMENTATION OF COUNTRY PROGRAMMES

Data on Controlled Substance
Year: January to December 1999

IMPLEMENTATION OF COUNTRY PROGRAMMES
ADMINISTRATIVE AND SUPPORTIVE ACTIONS

TYPE OF ACTION / LEGISLATION 1. REGULATIONS:	Action was proposed in country programme	Action taken this year or ongoing for less than 1 year	Action is ongoing for longer than 1 year
1.1 Establishing general guidelines to control import (production and export)[9] of ODS.	A policy to gradually limit through quotas – or prohibit exports of ODS. - A regulatory policy which provides a phase-out schedule for production and imports, using a base year, but controlling based upon overall ODP so that specific product manufacturing and import flexibility can be maintained.		Banning of ODS imports from non-party countries Banning of ODS imports in disposable cylinders
1.2 Requiring special permits for import or sale of bulk ODS			
1.3 Requiring special permits for import or sale of products or equipment containing ODS	A policy to prohibit manufacturing, imports, exports and national commercialization of new final products which contain ODS, except for repair parts and components to be used in the existing systems and equipments. The dates chosen will be in phase with the completion of appropriate sectoral phase-outs.		Use of Annex A and B ODS banned in the following sectors: As of 29/Dec/95 Fire extinguishing sector Central Air Conditioning Sector Refrigeration facilities greater than 100HP Aerosols As of 01/Jan/97 New MACs As of 01/Jan/99 Solvents As of 01/Jan/2001 All MACs Domestic Refrigeration Foams Commercial Refrigeration Sterilants
Banning import or sale of bulk quantities of			
1.4 CFC-11		Measure to be adopted in 2000	

1.5 CFC-12		Measure to be adopted in 2000	
1.6 Halon 1211			
1.7 Halon 1301			
Banning import or sale of			
1.8 Used CFC – containing domestic refrigerators of freezers			Banning import of recycled CFC
1.9 ODS – containing aerosols except those for essential uses such as MDI			
1.10 automobiles containing mobile air conditioning equipment using CFC-12			
1.11 air conditioners and chillers using CFC			
1.12 Requiring training of refrigeration service technicians	A policy which provides for the training and the certification of technicians who are involved in the installation and repair of refrigeration equipment, as well as those who will be engaged in the recycling and recovery programmes of the country.		To be implemented soon, with the start of the recovery and recycling project
1.13 Requiring certification of refrigeration service technicians	A policy which provides for the training and the certification of technicians who are involved in the installation and repair of refrigeration equipment, as well as those who will be engaged in the recycling and recovery programmes of the country.		To be implemented soon, with the start of the recovery and recycling project
1.14 Banning the use of ODS in production of some or all types of foam			
Other Regulations			
1.15	A policy to define annually decreasing ODS production quotas for every local producing company, with reference to its own 1993 production level, along with the gradual annual rise of import taxes for the same substances.		Measure undergoing study
1.16	A policy to define increasing federal and/or State taxes aplied on ODS.		
1.17	Investment policies which encourage the use of ODS substitutes and discourage the use of ODS by the various industry sectors.		
1.18	Taxation policies which exempt MLF grants from taxes.		Import tax has already been reduced for equipment required for industrial conversion projects
1.19	Tax incentives to encourage consumers adoption of alternative technologies, i.e. differentiating federal and/or State sales/Industrial Products Taxes applied to		

	ODS-free products as, from those applied to products using ODS.		
1.20	The evaluation of a policy that provides a favorable interest credit line for enterprises who engage in activities and projects which are complementary to, but not funded by, the Multilateral Fund.		
1.21	A regulatory programme which prevents the unauthorized alteration of ODS free systems, in order to prevent the return to ODS.		Measure under study for implementation
1.22	In order to promote recovery/ recycling, a policy that prohibits venting or other voluntary emissions during operation or maintenance of ODS containing equipment, except for essential uses as established by law.		Measure implemented in the states of Rio Grande do Sul, São Paulo and Rio de Janeiro
1.23	A programme to develop quality standards for alternatives as well as recycled gases and recycling equipment, so that phase-out momentum is maintained.		
2. ESTABLISHMENT OF INSTITUTIONAL FRAMEWORK FOR MANAGEMENT OF ODS PHASE-OUT (e.g. National/sectoral committees, working groups).			Use of Annex A and B ODS banned in the following sectors: As of 29/Dec/95 Fire extinguishing sector Central Air Conditioning Sector Refrigeration facilities greater than 100HP Aerosols As of 01/Jan/99 New MACs As of 01/Jan/99 Solvents As of 01/Jan/2001 All MACs Domestic Refrigeration Foams Commercial Refrigeration Sterilants
3. ESTABLISHMENT OF PROCEDURES FOR CERTIFICATION OF SERVICE TECHNICIANS.			
4. ESTABLISHMENT OF CHANNELS FOR PUBLIC INFORMATION ON ODS CONTROL ACTIONS.	A public awareness policy aimed at the importance of the ozone layer issue and its effects in		

	life on the Planet - particularly human - and the current national and international Government and Industry actions to address the problem, as well as reporting the overall contribution of the country to the Montreal Protocol.; - Specific awareness programmes aimed at reaching out to the small size industries and service companies, therefore creating the economic climate which will allow labeling to have an economical incentive impact, and reporting on overall contribution of the country to the Montreal Protocol.		
5. MONITORING ACTIVITIES:			
5.1 Establishment of a system for monitoring and monitoring of import, (production, export) and use of ODS.			Measure adopted with the inclusion of foreign ODS trade in the Foreign Trade System - SISCOMEX
5.2 Establichment of monitoring and evaluation system for implementation of MLF projects and monitoring / evaluation of MLF projects.			Establishment of a system to follow the implementation of ODS conversion projects
5.3 Establishment of procedures for ODS data collection/update and transmission/dissemination.			Measure adopted with the implementation of a register of companies that use, manufacture and trade (domestic and foreign) ODS
5.4 Annual collection/update and transmission/dissemination of ODS data.			Measure adopted with the implementation of a register of companies that use, manufacture and trade (domestic and foreign) ODS
5.5 Monitoring of recovery and recycling of ODS			
5.6 Monitoring and evaluation of training activities.			
5.7 Establishment of product quality standards. E.g.: “Ozone Seal”, “Green Label”. Etc.	A labeling policy, which provides for the labeling of substances that are friendly to the Ozone Layer. This will have to be combined with a public awareness programme that assures economic driving force in favor of ODS free technology.		

5.8 Enforcement of product quality standards			
6 OTHER			
6.1		Inclusion of the ozone issues in the environmental crimes	
6.2		Forbidding of acquisition of equipment containing ODS by Government entities	
6.3		Regulamentação da Lei de crimes ambientais	
6.4		Conclusão do estudo de consumo de SDO nas pequenas e médias empresasRegulamentação da Lei de crimes ambientais	

ANNEX 4. – COMMERCIAL REFRIGERATION EQUIPMENT MANUFACTURING ENTERPRISES IDENTIFIED BUT OTHERWISE NO DETAILS ON PRODUCTION VOLUME, CFC CONSUMPTION, OR ELIGIBILITY FOR MLF ASSISTANCE

Enterprise Details	Products/Sector Activity
AMAZONAS STATE	
Industria de Refrigeradores da Amazonia Ltda Rua Acacias, 48, Manaus, AM, 69068-510 Phone: (92) 6132442	Industrial Refrigeration
Industria e Comercio Clima Frio Ltda Av Joaquim Nabuco, 1684, Manaus, AM, 0 Phone: (92) 2343412	Industrial Refrigeration
Refrima SA Equipamentos Industriais Rua Jutaí, 200, Distrito Industrial Manaus, AM, 69075-130 Phone: (92) 6152171	Industrial Refrigeration
Sadia Concordia SA Industria e Comercio Bc Batista, 1019, Manaus, AM, 69070-350 Phone: (92) 6423400	Industrial Refrigeration
BAHIA STATE	
Resul Refrigeração Superfrio Ltda Jose Joaquim Seabra, 453, Baixa Sapateiros Salvador, BA, 40025-000 Phone: (71) 2439483 Fax: (71)2439483	Service and self service refrigeration cabinets
Sudoeste Industria de Balcões Av. Guanambi,2350, Alvorada Vitoria da Conquista, BA, 45100-000 Phone: (77) 4222182 Fax: (77) 4222182	Service and self service refrigeration cabinets
Gelemax Industria de Refrigeração Ltda Rua Belem 797, Feira de Santana, BA, 44040-000 Phone: (75) 2231111 Fax: (75) 2231111	Service and self service (58 employees) Refrigeration cabinets
Gelonorte Industria e Comercio Rua Oratorianos, 64 Salvador, Ba, 41315-090 Phone: (71) 246 3651	Service and self service Refrigeration cabinets
CEARA STATE	
Isofrio Industria e Comercio de Refrig. Rua Teodoro Cabral, 693 Fortaleza, CE, 60337-190 Phone: (85) 2284621 Fax: (85) 2281470	Service and self service Refrigeration cabinets
Kent Frio Com e Ind de Refrigeração Ltda Rua Caririaçu, 696 Fortaleza, CE, 60326-380 Phone: (85) 2815279 Fax: (85) 2143951	Service and self service Refrigeration cabinets
Tau Industrial e Tec Ltda Vila Tambaú, 210 Fortaleza, CE, 60331-700 Phone: (85) 2284866 Fax: (85) 2284656	Service and self service Refrigeration cabinets

Geto Maquinas Com e Ind de Refrigeração Rua Braz de Francesco, 381 Fortaleza, CE, 60325-010 Phone: (85) 2900432	Commercial Refrigeration Equipment
Maderce Maquinas de Refrigeração Ceará Av. Santos Dumont, 2626 Fortaleza, CE, 60150-161 Phone: (85) 2610455 Fax: (85) 2629117	Commercial Refrigeration Equipment
Frio Refrigeração Industria e Comercio Ltda Rua Joaima, 68 Fortaleza, CE, 60331-230 Phone: (85) 4855287	Commercial Refrigeration Equipment
GOIAS STATE	
Refrigeração Forte Ind e Com Rua Paissandu, 166 Goiana, GO Phone: (62) 2972034	Service and self service Refrigeration cabinets
Zama Ind e Com de Refrigeração Rua F Vinte e Dois, 20 Goiana, GO Phone: (62) 2894280	Service and self service Refrigeration cabinets
Norte Sul Refrigeração Ind e Com Av Altamiro de Moura Pacheco, 513 Goiana, GO, 74423-020 Phone: (62) 8830601 Fax: 2562385	Cold rooms & Refrigeration cabinets
Madefrio Refrigeração Ind e Com Rua Jovino de Melo Oliveira, 11 Anápolis, GO Phone: (62) 3213848	Refrigeration cabinets
MATO GROSSO SUL STATE	
Reletron Maq e Equip de Refrigeração Av Filinto Muller, 1007 Varzea Grande, MT, 78110-000 Phone: (65) 6826666 Fax: 6821011	Refrigeration cabinets, Drinking water fountains & Ice-cream equipment
Refrigeração Athenas Ind e Com Av Couto Magalhães, 2725 Cuiabá, MT, 78110-400 Phone: (65) 6843014	Commercial refrigeration
Refrigeração Paulo Ind e Com Av Castelo Branco, 749 Várzea Grande, MT, 78110-200 Phone: (65) 6822998 Fax: (65) 6821006	Refrigeration cabinets
Refrigeração Nacional Ind e Com Rua Carlos Gomes, 75 Várzea Grande, MT, 78148-040 Phone: (65) 6826878	Commercial refrigeration
Freezer Refrigeração Com e Ind Rua 15 de Novembro, 9 Cuiabá, MT Phone: (65) 3210422	Commercial refrigeration
Ind e Com de Refrigeração Maqui Frio Rua 19, 1363 Tangará da Serra, MT Phone: (65) 3263810	Industrial refrigeration

MINAS GERAIS STATE	
Positec Industria e Comercio de Refrigeração Rua Paiva, 50. Belo Horizonte, MG, 30512-460. Phone: (31) 33864278	Refrigeration cabinets
Frio Forte Ind e Com de Refrigeração Ltda Rua Fernando Lima Junior, 120. Itaúna, MG Phone: (37) 32414100	Refrigeration cabinets
Friolux Ind e Com de Refrigeração Ltda Rua Antonio Bitarelli, 50 Juiz de Fora, MG. Phone: (32) 32357999	Vertical and Horizontal Refrigeration Cabinets
Lesfri Ind e Com de Refrigeração Ltda Rua Madre Perpétua, 44. Juiz de Fora, MG, 36052-560. Phone: (32) 32170667	Refrigeration cabinets
Recilfrio Rego Com e Ind Ltda Rua Jefferson, 656 Contagem, MG, Phone: (31) 33336801	Refrigeration cabinets
Refrigeração Iceberg Ind e Com Ltda Rua Engenho do Sol, 499. Belo Horizonte, MG. Phone: (31) 4183188	Refrigeration cabinets
FR Frio Industrial Ltda Av Brigadeiro H. Melo, 583. Belo Horizonte, MG, Phone: (31) 33710725	Industrial Refrigeration
Geloart Ind e Com de Refrigeração Av. Levindo Ribeiro do Couto, 416. Pouso Alegre, MG. Phone: (35) 34233255	Commercial Refrigeration
Gelocar Refrigeração Industria e Comercio Rua CV Lara, 260. Carmópolis de Minas, MG. Phone: (37) 33331402	Commercial Refrigeration
Gelofrio Industria e Comercio Ltda Rua Verão, 201. Contagem, MG. Phone: (31) 33932232	Commercial Refrigeration
Icer Ind e Com Equipamentos de Refrigeração Rua V Brasil, 271. Belo Horizonte, MG. Phone: (31) 34413823	Commercial Refrigeration
Leili Eletro Refrigeração Industrial Ltda Av Prof Manoel Martins, 376. Conselheiro Lafaiete, MG. Phone: (31) 37621119	Commercial Refrigeration
Isobase Com e Ind Ltda Rua Uganda, 55. Belo Horizonte, MG, 31785-500. Phone: (31) 34556133	Cold Rooms
Frigeral Refrigeração Av José Faria da Rocha, 2933 Contagem, MG, 32310-210 Phone: (31) 33914422 Fax: (31) 33914692	Commercial refrigerators, Self service cabinets, & Cold rooms

Friomax Ind e Com de Refrigeração Rua São Paulo, 1500. Vespasiano, MG, 33200-000 Phone: (31) 36213327	Commercial refrigerators, Service & Self service cabinets, & Cold rooms
PERNAMBUCO STATE	
Polifrio do Nordeste Ltda Av Assesipe, Qd A Lt 10 Abreu e Lima, PE, 53520-790 Phone: (81) 35421377 Fax: (81) 35421624	Cold rooms & Refrigeration cabinets
Ind e Com Norfrio Ltda Rua Imperial, 2172 Recife, PE, 51220-000 Phone: (81) 34281466	Cold rooms
Fricon Rd Br-101, km 51.7 Paulista, PE, 53400-000 Phone: (81) 34385033 Fax: (81) 34385986	Vertical and Horizontal Refrigeration Cabinets
Metalpraz Metalurgica Prazeres Ltda Rua Mata Grande,3033 Jaboatão dos Guararapes, PE, 54340-000 Phone: (81) 4791222 Fax: (81) 4791384	Refrigeration cabinets
RIO DE JANEIRO STATE	
7 Mares Ind e Com Frigorífico Rua Jose Maia Oliveira, Quadra 143 Itaguaí, RJ, 23820-000 Phone: (21) 2687 6292 Fax: (21) 2687 6293	Commercial refrigerators & freezers
Fábrica Geladeiras Comerciais Zeus Rua Conde de Leopoldina, 504 Rio de Janeiro, RJ, 20930-460 Phone: (21) 2261 1397	Commercial refrigerators
Sodima Ind e Com Rua Bráulio Cordeiro, 710 Rio de Janeiro, RJ, 20975-090 Phone: (21) 2261 1397	Commercial refrigeration
Waldesonia Ind e Com Av Dom Mariano, 292 Barra Mansa, RJ (24) 3322 5925	Service/Self-service cabinets
Colder Refrig Com e Ind Av Heitor Beltrão, 44 Rio de Janeiro, RJ, 20550-000 Phone: (21) 2567 2287	Service/Self-service cabinets
Frigopanel Ind e Com Rua Matriz, 70 São João do Meriti, RJ, 25520-640 Phone: (21) 2662 5134	Cold rooms
Dom Carmine Ind e Com Refrigeração Rua Antonina Serrão, 44 São Gonçalo, RJ, 24445-270 Phone: (21) 2712 5062 Fax: (21) 2604 9158	Cold rooms
SÃO PAULO STATE	

Alphagel Ind e Com de Maquinas Rua Silvio Tozzi – Nuc Pres Wilson Jandira, SP, 06602-020 Phone: (11) 4789 2556 Fax: (11) 3965 7438	Ice-cream equipment
Arpifrio Ind e Com Ltda. Rua Hortencias, 1301 Santo André, SP, 09175-500 Phone: (11) 4451-5922	Ice-cream machines
Brasfrio Ind e Com Ltda. Rua Rio Tiete, 191 São Carlos, SP, 13565-190 Phone: (16) 261-5721	Ice-cream equipment
Inatec Ind e Com Maq Sorvetes Rua Jose Melio dos Reis, 408 Sertãozinho, SP, 14161-199 Phone: (16) 645-1661	Ice-cream machines
Fabrica Balcões Frigoríficos Dracena Rua Alécio Perosso, 154 Dracena, SP, Phone: (18) 821-2603	Service and Self service cabinets
Fabrifrio Refrig Ind e Com Ltda. Av Getulio Vargas, 1870 São Carlos, SP, 13570-390 Phone: (16) 271-1476 Fax: (16) 271-4066	Industrial refrigeration
Friar Ind Metalúrgica Ltda Av. Jardim, 1050 Pirajuí, SP Phone: (14) 572 1115	SM cabinets
Ind e Com Refrigeração Cacers Ltda Av. Modesto Jose Moreira Junior Mirassol, SP Phone: (17) 242-5019	Service cabinets
Class Frio Ind e Com de Refrig Rua João Francisco de Oliveira, 32 Piracicaba, SP, 13425-150 Phone: (l8) 3426 1883	Commercial refrigeration cabinets
Ind e Com de Refrig. Araçatuba Av. Brasilia, 999 Araçatuba, SP Phone: (18) 623 8464	Service and Self service cabinets
Ind Refrig Gelux Rua Aguapeí, 300 Araçatuba, SP Phone: (18) 624 5157	Commercial refrigeration cabinets
Mogifrigor Ind e Com Av Presidente Castelo Branco, 1501 Mogi das Cruzes, SP Phone: (11) 4761 7077 Fax: (11) 4761 6656	Service and Self service cabinets
Remafrig Maq Equip Frigoríficos Rua Germano Moreira, 36 Batatais, SP, 14300-000 Phone: (16) 3761 8628	Vertical refrigeration cabinets
SuperFrio Câmaras Frigoríficas Rod SP 215 Com, 33 Vargem Grande do Sul, SP Phone: (19) 641 1254	Cold rooms

Mar Frio Refrigeração Ind e Com Av Fortunato e Vetorazzo, 500 São Jose do Rio Preto, SP Phone: (17) 236 6065	Commercial refrigeration
Max Refrigeração Ind e Com Rua Germano Dix, 5001 Pirassununga, SP, 13633-000 Phone: (19) 561 8016	Service cabinets
Monte Alegre Ind e Com Refrigeração Av D. Pedro I, 1946 Ribeirão Preto, SP, 14055-630 Phone: (16) 633 1335 Fax: (16) 633 1745	Cold rooms/refrigeration cabinets
Porto Frio Ind e Com Refrigeração Av Otavio Augusto Rangel, 177 Votorantim, SP, 18112-000 (15) 243 1748	Service/Self service cabinets
Refrigeração Refrilar Ind e Com Rua Damião Pinheiro Machado, 450 Botucatu, SP Phone: (14) 821 6652	Refrigeration cabinets

Key	Possible duplication with list of enterprises in Chapter 6, Section 4, Table 6.5

ANNEX 5. - ENVIRONMENTAL ASSESSMENT

All project components proposed under the National CFC Phase-out Plan will employ alternative technologies that are recommended by UNEP Technical Options Committees for the relevant sectors. All projects will comply with applicable government environmental, health and safety regulations.

All project components proposed under the Plan will enable existing enterprises to convert to non-ODS alternatives. Therefore, no job loss or any adverse social impact is envisaged.

ATTACHMENTS

ATTACHMENT 1.

TRAINING OF REFRIGERATION MECHANICS IN THE DOMESTIC & COMMERCIAL REFRIGERATION SERVICE SUB-SECTORS

COUNTRY:	Brazil
PROJECT TITLE:	Training of Refrigeration Mechanics in the domestic & Commercial Refrigeration Service Sub-sectors
PROJECT IN CURRENT BUSINESS PLAN:	Yes (GTZ)
SECTOR:	National CFC Phase-out Plan
ODS USE (2000):	9,276 ODP tons
SUB-SECTOR:	Refrigeration Service Sector
ODS USE IN THE SECTOR IN SUB-SECTOR	4,197 ODP tons
PROJECT DURATION:	36 months
PROJECT COSTS:	
REQUESTED GRANT:	**US$ 5,968,790**
IMPLEMENTING AGENCY SUPPORT COST:	**US$ 596,879**
TOTAL COST OF PROJECT TO MULTILATERAL FUND:	**US$ 6,565,669 to be set off against German bilateral contributions**
IMPLEMENTING AGENCY FOR THIS PROJECT	GTZ
COORDINATING AGENCY FOR THE NATIONAL CFC PHASE-OUT PLAN:	UNDP
NATIONAL COORDINATING AGENCY:	PROZON

PROJECT SUMMARY

This project is to train refrigeration mechanics and technicians, engaged in the installation and maintenance of domestic and commercial refrigeration systems and equipment throughout Brazil, in CFC management and conservation, including recovery, recycling, recharge, replacement refrigerants, retrofit refrigerants, and storage. This is necessary to reduce CFC consumption in the service sector, which is the largest remaining CFC consuming sector in Brazil. In order to be successful in reducing CFC consumption, some 60,000 refrigeration mechanics and technicians in the country need to be trained.

The project will be implemented through a total of 2,250 training courses organized throughout Brazil. The training programme will concentrate on the most essential service practices that are mainly responsible for the excessive consumption of CFCs. These practices are largely connected to the understanding and motivation of technicians. The activities of the project are designed in an integrated way and enhance a sustained change in behaviour and practices.

The training project is related to a separate investment project that will provide appropriate equipment to trained mechanics and technicians that will enable them to recover CFC 12 and replace it with non-CFC refrigerants in the course of their repair work on CFC based refrigeration systems. The courses will address related issues of environmental protection and specific legislation.

50 Trainers will be trained in this project. Those together with other experts in their institutions will responsible for the organization of 2500 training courses for refrigeration technicians and mechanics. In designing and implementing the training programme, full account will be taken of the experience gained from the ongoing Pilot Training Programme presently implemented by GTZ. The government of Brazil has requested the GTZ to assist in the implementation of the training project.

PROJECT OF THE GOVERNMENT OF BRAZIL

1. BACKGROUND & PROBLEM IDENTIFICATION

1.1. CFC consumption in the sectors

Since 1994 when the Country Programme was prepared it has been recognized that the largest single CFC consuming sector in Brazil was the refrigeration and air-conditioning service sector. Table 1.1.1 gives an overview of the service sector consumption, which in 2000 accounted for a total of some 4,945 ODP tons. The major contributors to this consumption are the commercial and domestic refrigeration, and mobile air-conditioning (MAC), service sectors.

Table 1.1.1 Refrigeration & Air-conditioning Service Sector CFC Consumption

	CFC Consumption (ODP tons)						
	1994	1995	1996	1997	1998	1999	2000
Service Sector CFC Consumption	4,186	4,037	4,069	3,870	4,930	5,137	4,945
Total Annex A CFCs Consumption	10,751	10,880	10,872	9,815	9,543	11,612	9,276
Service Sector CFC Consumption as % of Total Annex A CFCs Consumption	39%	37%	37%	39%	52%	44%	53%

1.2 Refrigeration and Air-Conditioning Service Sub-sector CFC Consumption

Table 1.2.1 provides a breakdown of the consumption of the 4,945 ODP tons of CFCs in 2000 in the refrigeration and air-conditioning service sectors. This is based on surveys conducted for preparation of the National CFC Phase-out Project.

Table 1.2.1 Refrigeration & Air-conditioning Service Sub-sector CFC Consumption

Service Sub-sector	Consumption in 2000 (ODP tons)		
	CFC 11	CFC 12	Total
Commercial Refrigeration	-	3,297	3,297
Domestic Refrigeration	-	900	900
Industrial Refrigeration & Central Air-conditioning	28	60	88
Mobile Air-conditioning	-	660	660
Total	**28**	**4,917**	**4,945**

The major contributors to this consumption are the domestic and commercial refrigeration service sub-sectors that accounted for 4,197 tons (85%) of the total consumption of 4,945 ODP tons. This consumption of CFCs includes the complete replacement, or top-up, of refrigerant losses during equipment operation, as well as the replacement of the refrigerant charge vented to atmosphere during service and repair activities, purging and overcharging practices.

The estimated population of domestic refrigerators and freezers in the Brazilian market is now some 62 million units, of which some 55 million contain CFC 12 refrigerant representing a 'bank" of around 8,250 ODP tons of CFC 12.

The population of commercial refrigeration equipment based on hermetic compressors and the associated inventory of CFC 12 has been estimated based on data from the principal compressor manufacturers and local industry experts. The results are illustrated in the following Table 1.2.2.

Table 1.2.2 Unitary Commercial Refrigeration Equipment Population & CFC 12 Inventory

EQUIPMENT TYPE	EQUIPMENT INVENTORY (Units)	CFC 12 INVENTORY (Tonnes)
Unitary Equipment	7 million	2,800
Drinking Water Coolers	4 million	200
Condensing Unit Equipment	0.9 million	900
TOTAL	**11.9 million**	**3,900**

While since the early 1990's most new commercial refrigeration equipment for larger cold storage facilities and central systems for supermarkets has been based on refrigerant HCFC 22, a March 2002 survey of the equipment operated by the largest supermarket chain in Brazil confirmed that there is still a large population of older CFC 12 based equipment in operation. Data from this supermarket survey indicated a recharge rate of 72% of initial charge during service and repair activities.

It was estimated that the total annual consumption of CFC 12 for service and repair activities related solely to central systems for supermarkets is around 350 ODP tons. To this must be added the consumption for other open-drive compressor based systems in large cold storage facilities, and of course consumption in the transport refrigeration service sub-sector.

More detailed information on the CFC consumption in the refrigeration and air-conditioning service sectors can be found in the main part of the National CFC Phase-out Plan.

Beside the large population of existing CFC based equipment in the country, there are other important reasons for the high level of consumption by the service sector:

The **low standard practices** in environmentally friendly maintenance and repair services;

Low quality of the air conditioning and refrigeration **installations**, mainly resulting from extended life time usage and inappropriate commissioning and service;

Non existence of refrigerant **recovery, recycling** and reclaiming practices;

Lack of awareness of environmental issues;

Due to the low cost of labour that makes repairs more attractive financially than replacement with new equipment, domestic refrigerators and freezers to have very **long working lifetime**s in excess of 20 years, and commercial refrigeration equipment lifetimes can extend as long as 15 years. Data on a sample of 47 centrifugal chillers in Sao Paulo and Rio de Janeiro revealed that 45% were between 27 – 32 years old.

Reliable sources estimate that throughout Brazil some 60,000[1] service mechanics are involved in the refrigeration and air-conditioning service sector. The remainder, numbering less than 5,000, are mechanics that are associated with OEM authorized repair shops. They can render better quality services since they have received some technical training and have better working conditions, but are still in need for training.

The vast majority of these mechanics deliver sub-standard services, because they have only knowledge on servicing with CFC, never had the opportunity to participate in any kind of training, and additionally lack appropriate tools. Servicing CFC based equipment has taken decades of learning curves for those technicians to provide a minimum acceptable standard in the market. In case CFC is regulated in the market, the know how on extending the lifetime of CFC based equipment with non-CFC servicing techniques is not available.

The need to replace CFC and introduce drop-in refrigerants, retrofit and conservation service technologies cannot be achieved through such a “traditional qualification system” of trial and error in a short time.

The great majority of the workshops have just one mechanic who is generally also the owner. The workshop is mostly their single income opportunity. Many of them have never had any training and have acquired their knowledge mostly through other mechanics or autodidactic trial and error. The average income of these workers, considering authorized workshops and the informal sector in the South and South-East regions is about US$ 350/month. For the other regions of the country this figure is as low as US$ 200/month.

In the normal course of maintenance it is common practice that the refrigerant charge is vented. This is the direct consequence of the lack of a qualified workforce that also lacks the appropriate tools, including the means for removing and recovering the refrigerant. It is also exacerbated by the absence of awareness of the environmental problems resulting from CFC emissions to the atmosphere and the lack of knowledge on using alternative “drop-in” and “retrofit” refrigerants for replacement of CFC.

Leakages account for 60% to 80% of the installed capacities in the commercial sector. This is largely due to lack of proper maintenance and repair practices and tools. Additionally there is an unaccounted loss from improper containment and storage practices.

Without adequately trained service technicians at hand, investment activities in the field of recycling and recovery or end-user conversion cannot be successfully achieved.

Without proper training, the economy will face serious threats from sub-standard services, which is going to damage and partly destroy equipment and/or stimulate an excessive demand and use of CFC 12. This will encourage the creation of black marketing of CFCs.

Moreover the enforcement of national regulations and last not least, the economic wealth of the workshop owners and their families is at stake.

[1]There are no official statistics about the number of refrigeration mechanics that exists in the Brazilian market. The number of 60,000 was estimated by EMBRACO from the circulation data for their publication “Bola Preta”.

These examples illustrate the great potential and need for a training activity as an essential accelerator for the final elimination of CFC. Service technician training is the precondition for the successful implementation of final phase out efforts in the country.

The information provided here for problem identification shows that the economic conditions of the country and the cultural practice of re-using machines and equipment are decisive elements to be considered in a strategy for CFC phase-out in the domestic and commercial refrigeration services sub-sectors.

2. OBJECTIVES

The primary objective of this project is to train technicians and mechanics, engaged in the installation and maintenance of domestic and commercial refrigeration systems and equipment throughout Brazil, in CFC management and conservation, including recovery, recycling, recharge, replacement refrigerants, retrofit refrigerants, and storage. This is essential in order to achieve reductions in CFC consumption in the service sector that will enable Brazil to meet its obligations under the Montreal Protocol, and the Government to achieve CFC phase-out in 2007, at an acceptable level of economic impact to the country.

The refrigeration technicians and mechanics will be trained in best practices for the activities involved in CFC management, conservation, and replacement, including recovery, recycling, reclaiming, recharge, storage, retrofit, leak detection, containment and “drop-in” techniques. The courses will also comprehend specific general targets like environmental education, standardization practices and national regulations. The emphasis will be on CFC 12 recovery, and conversion from CFC 12 to “drop-in” refrigerants, in all service and repair activities.

Experiences from other countries have shown that the qualification and motivation of technicians and mechanics in the service sector plays an essential role. Therefore, the proposal gives great emphasis on a practical training, which has best proven, to provide reliable success in training and traceable results in the field.

The effectiveness and sustainability of the training measures are supported by a number of activities, which will help to Brazil meet its obligations and achieve its goals relating to CFC consumption. These activities include certification, monitoring and evaluation, an information and reference network and the provision of a manual.

Altogether it is planned to train and to reach as many as possible of the 60,000 refrigeration technicians throughout Brazil with the help of the presented strategy. The programme will also target managers of workshops which are not necessarily technicians, but important decision makers.

Impact of the Training activity

It is estimated that this project can reduce CFC consumption in the domestic and commercial refrigeration servicing sector by at least 40 %, which can be generally expected for programmes of this type under the MF.

The training will qualify technicians to conserve and to replace CFC 12 coupled with “retrofit” and “drop-in” refrigerants whenever technically possible during equipment repair or service activities.

It will qualify for management and containment of CFC 12 refrigerant and lead to a part or complete reduction of large amounts of CFC which are presently wasted through leakage, wrong maintenance practices as well as sub standard recovery, storage and containment.

In industrial countries for example, the same training has proved to reduce leakage in the commercial service sector from rates of 40% to 3%. This practices have other important environmental side benefits, e.g. like the improvement of the equipment energy efficiency. In Brazil leakage rates are much higher and rates of more than 60% are common.

The training programme is supported by a separate investment project that will provide recovery and storage equipment to trained technicians and mechanics to enable them to recover CFC 12 and replace it with recycled CFC or drop-in refrigerants, depending on technical, and economical aspects, in the course of their repair work.

In order to receive the recovery equipment, service shops must have at least one of their technicians trained and certified at one of the training courses under the project. Training centres will provide a list of certified technicians to PROZON. PROZON will maintain a database for follow up and monitor certified technicians and the service shops that they are associate with.

The training programme will qualify service technicians to phase-out CFCs and prepare them for the future short term reduced availability of CFCs and the likely coming restriction, that PROZON may allow the sales of CFCs only to those who have been trained on proper handling of CFCs, etc.

3. METHODOLOGY

The training programme will be initially designed and implemented aiming at the training of 60,000 mechanics. The main assumptions adopted for taking this number are:

- 60,000 mechanics is estimated based on various records and might still be underestimated
- As the programme will have a monitoring and evaluation activity for adjustments to be made, if necessary the number of courses can be expanded in order to achieve a greater number of mechanics
- It is estimated that the participation rate of the mechanics is two third of the total or 67%.

Due to the large number of refrigeration mechanics to be trained, and the size of the country, the strategy to be used in the training programme is to integrate regular evaluation of activities that will allow the necessary adjustments and improvements in the course of project implementation. In the process priority is given to the regions with higher concentration of mechanics and CFC consumption. It can be assumed that there is a relationship between number of refrigeration mechanics in a region and the consumption of CFC in that region.

The following Table 2 presents the estimated distribution of the 60,000 mechanics by States and Table 3 in the five geographical regions of Brazil

Table 2. Distribution of the refrigeration and air conditioning mechanics by States (Source: EMBRACO)

STATE	No. of Mechanics	%
ACRE	90	0.15
ALAGOAS	606	1.01
AMAPÁ	6	0.01

AMAZONAS	372	0.62
BAHIA	3,156	5.26
CEARÁ	1,518	2.53
DISTRITO FEDERAL	696	1.16
ESPÍRITO SANTO	870	1.45
GOIAS	552	0.92
MARANHÃO	618	1.03
MATO GROSSO	762	1.27
MATO GROSSO DO SUL	918	1.53
MINAS GERAIS	3,828	6.38
PARÁ	1,464	2.44
PARAIBA	678	1.13
PARANÁ	2,550	4.25
PERNAMBUCO	3,090	5.15
PIAUI	486	0.81
RIO GRANDE DO NORTE	990	1.65
RIO GRANDE DO SUL	3,198	5.33
RIO DE JANEIRO	10,668	17.78
RONDÔNIA	444	0.74
RORAIMA	24	0.04
SANTA CATARINA	2,058	3.43
SÃO PAULO	19,878	33.13
SERGIPE	456	0.76
TOCANTINS	24	0.04
TOTAL	**60,000**	**100.00**

Table 3. Distribution of the Refrigeration and Air-conditioning Mechanics in the Geographical Regions and Estimated CFC Consumption in the Domestic and Commercial Refrigeration Services Sub-sectors

Region	No. of Mechanics	%	Estimated CFC Consumption (ODP tons 2000)
NORTH	2,430	4.05	170
NORTH-EAST	11,598	19.33	811
SOUTH-EAST	35,232	58.72	2,465
SOUTH	7,812	13.02	546
CENTRE-WEST	2,928	4.88	205
TOTAL	**60,000**	**100.00**	**4,197**

See Figure 1. A map of Brazil showing the geographical regions as colour coded inTable 3.

Based on the distribution presented in Table 3 and the criterion of developing the programme in a regional approach according to the concentration of mechanics and CFC consumption, the sequential start of the training activities will be based accordingly.

Training courses will be developed in the main cities of each region. The results achieved in each region will be used as a guide for the implementation of the programme for the whole country.

Management is a key factor for the success of this project. The numbers of technicians and mechanics involved, and the complexity of the logistics, are demanding a stringent coordination in this project.

Figure 1. Map of Brazil showing the states, main cities and geographical regions

4. INSTITUTIONAL FRAMEWORK

PROZON and UNDP are responsible for the overall coordination and implementation of the National CFC Phase-Out Plan. GTZ in consultation with PROZON and UNDP will be responsible for the coordination of the training subproject within the National Phase-out Plan.

SENAI (National Industry Training Service) has extensive experience and tradition in training programmes for technicians and mechanics and has 18 centres and several subdivisions for training of refrigeration and air conditioning. It will be the institution responsible for the organization of locations and courses.

SENAI has already been chosen for conducting the pilot training activities and is involved in the development of the training materials. Other institutions can be involved in the programme development and implementation like: ABRAVA (Brazilian Association of Refrigeration, Air Conditioning and Heating) and ELETROS (Association of Domestic and Commercial Refrigerator and Freezer Manufacturers).

5. PROJECT DESCRIPTION

The training component is targeted towards local capacity building in the refrigeration sector and is based on "best practices" in refrigeration maintenance and repair. Increased know-how in CFC management, conservation and replacement will directly impact on the use of ODS, as the refrigeration service sector is a significant contributor to the release of ODS as illustrated before. The training will help to control and reduce the release and use of CFCs for maintenance and service in the domestic and commercial refrigeration sector through actions to:

- Establish best practices for better hermetisation, leakage detection and control measures in the market;
- Establish procedures for CFC conservation including, recovery, recycling;
- Reduce and eliminate partly all unnecessary consumption and waste in the management, storage and containment of CFCs;
- Prevent wherever possible premature equipment retirement caused by non-availability of CFC12;
- Establish knowledge and technical know-how in best practices in the application of drop-in refrigerants and retrofit in the country;
- Contribute to efforts to reduce climate change by encouraging greater energy efficiency;
- Secure job opportunities in the maintenance sector through provision of proper knowledge on CFC conservation and replacement, thus avoiding dramatic negative economic impact on the income situation of workers in the sector and maintaining a trained labour force for the country.

The training targets technicians that are already working in the sector as well as trainers for refrigeration technicians in the Vocational Training Centres (VTC) and industry, those being an important intermediary group who contribute to the know-how of technicians and mechanics.

Trainers at the VTCs and industry are the essential knowledge base in the country and are responsible for passing on their information and know how. Therefore, this group of people and their institutions are used to establish 25 training focal points for CFC phase-out (TFPs) all over the country with a varying team of expert trainers. The final team of trainers will consist of 70 trainers including 45 from vocational institutes and 25 from the industry. Five training locations have been already established during the pilot phase, with 20 Trainers being operational. The need to establish these 25 TFPs is absolutely necessary in order to have sufficient distribution throughout the country. Otherwise the travel cost will be too high for mechanics. Even though in many cases not centralized training will need to be provided with the help of mobile units. These mobile units will be equipped with the Demonstration Units described later.

The TFPs will be divided according to the number of potential trainees and availability of training institutions. Among the tasks of the training focal points there is to:

- Identify all technicians/mechanics in region/state;
- Establish their state of the art and skills;
- Select eligibility for the various training modules;
- Register training participants, their business coordinates, CFC consumption and document services and progress provided;
- Approve the appropriateness of available materials and equipment for the envisaged group of technicians/mechanics;
- Organize and stratify module sessions for various groups of technicians/mechanics;

- Conduct practical training and hands on advise as laid down in the module curricula, adapt to eventually existing local needs;
- Do examination tests and provide certifications;
- Provide adapted manuals for examined technicians;
- Remain to be a reference information provider after the training and disseminate promotional materials;
- Cooperate with industry and suppliers in the distribution of CFC phase out information materials;
- Coordinate post training activities such as monitoring and provide required information to PROZON.

Initially the course, which has been developed in the pilot project for training of the trainers will be given to the trainers. Later on these trainers will carry out the courses for the technicians. Based on the expected participation rate, there is a need to hold a total of 2500 modules/courses. Each type will focus on a specific application or technology. The modules for combination will entail following topics (extract):

Basic modules

The Ozone Layer Depletion and Regulation of Refrigerants

The Ozone Layer, Refrigerants (CFC, 134 a and other HFCs, HCFC, Ammonia, Hydrocarbons), The Montreal Protocol, Legislation and national Regulations, Climate related questions

Overview Refrigerants, Refrigeration Cycle and Service Principles

Compressor, Condenser, Evaporator, Expansion Devices, Filters, Refrigerants (HFC 134a and others), Temperature/Pressure, Compressor Lubricants, Safety/Health issues, Compressor failure/repair**,** hermetisation techniques, leakage detection and control, Refrigerant/Oil Monitoring, Contamination, Containment, Pressurization,

Refrigerant Recovery and Recycling

Cleaning and Evacuation, Refrigerant Recovery, Refrigerant Storage, Safety Procedures while Refrigerant Recovery, Refrigerant Recycling, Maintenance, Tools Types of Recovery Equipment, Operation, Safety Devices, Piercing pliers, Cylinders for recycled Refrigerant storage, High/low pressure

Drop-in, and Retrofit Practices

Drop-in Refrigerants, Retrofit practices, Safety, Materials,

Specialised Modules

Servicing of Domestic Refrigeration Systems

Changes in Cleaning and Evacuation Operations, Use of the Appropriate Lubricating Oil, Use of the Appropriate Filter-Dryer, Safety, Replacement refrigerant

Commissioning and service of Commercial Refrigeration Systems

Soldering, pipe works, identification of and leakage control, Components, Protocols, Error detection, refrigerant recovery, System charging, Energy conservation measures, Refrigerant loss during maintenance, Contamination, Logs, Containment practices, Pressurization systems, leakage,

The training strategy will aim for a permanent change in the practice of the refrigeration maintenance sector of 'today' and motivate technicians to abandon previous inefficient practices.

- Training courses are based on the principle of learning by doing and focus on practical training.
- The separately carried out investment programmes in the frame of the NPOP will encourage the participation in the courses.
- Wherever possible, the training courses are incorporated into existing training courses and facilities, thus preventing the duplication of work and in order to benefit as much as possible from existing infrastructure.

Train the trainers course
As outlined earlier, the objective of this training course is to enable trainers from vocational training centres and industry to provide qualified training courses on CFC management, conservation and replacement. Therefore, a selected number of trainers from VTCs and industry identified by the National Ozone Unit (NOU) and SENAI will receive a 2-week course. The course will be provided by a reputed institution and in coordination with nationally responsible training institution SENAI. In total it is planned to train 50 professional trainers.

Training will be provided in varied aspects of refrigeration service and maintenance. All the abovementioned modules will be part of the training. In addition they are advised on administrative and organizational issues, as well as monitoring and reporting demands. Examination and test sheets are worked out together.

Trainers will receive on completion of the training course training materials and the demonstration unit, which has been self built by them during the course. It is free of charge and serves as a teaching aid for conducting their future courses. The units are small refrigeration systems that are especially designed for demonstrating CFC conservation and replacement practices. They operate on various refrigerants for example R12, R22, R134a, R600a, R290 and other blends and are used to demonstrate practices on evacuation, drop in, retrofit and leakage detection. The demonstration units are especially important for those trainers who need to use mobile units.

The benefit of self-built units is, that they are cheaper than ready-made units. By building the units themselves, trainers are better qualified in using, demonstrating and maintaining the units for later training purposes.

Furthermore the availability of standard training equipment for each training institute will be necessary. Refrigerant recovery and recycling machines, cylinders, leak detectors, vacuum pumps, refrigerant identifier, and other equipment/tools for demonstrations will be acquired by the project and given to the trainers after the conclusion of the training programme.

5.2 Implementation of Refrigeration Technicians training courses

Technicians will participate in a 4 day course on average. The exact length depends on the modules that are included in a course.

There will be groups of 16 technicians in each course. The predicted number of courses is about 2,500 (assuming a two third or 67% participation).

The time needed to complete the training programme will take until 36 month, depending on the availability of the technicians. It also depends on the accessibility of training spots. Therefore, part of the training will be done with the help of mobile training units, which can be used to provide training in decentralized locations. This is a common system in Brazil and extensively used by SENAI.

Among other references and didactic materials, the courses will utilize the training manuals prepared during the pilot training, which are adapted from the UNEP training manual to Brazilian conditions and the personal complements made by the Trainers while having received their train the trainer course. However, in the course of the training these manuals will be regularly revised and updated if necessary.

Technicians will be encouraged to apply to the training and certification courses through the publicity campaign, and other forms like indication by companies (equipment manufacturers or end users like supermarkets), wholesalers mailing list, etc. They will be selected based on the following criteria:

- Experience working as a refrigeration technician;
- Level of business;
- Passing of an entry test that will require a minimum level of knowledge and professional skill that will be evaluated through an interview.

Priority will be given to the refrigeration technicians working as supervisors in maintenance and repair shops. Considering that these professionals will influence their colleagues to acquire the same knowledge and techniques.

The trained trainers of the VCTs and the trained industry trainer will conduct the course in exchange. The inclusion of the industry trainer in conducting the course is an important aspect as they often have considerable practical experience that could be useful for the course. Moreover, there is likely to be greater acceptance of the training course if an industry trainer also participates. The trainers will be using the demonstration unit as a teaching aid. By means of the demonstration unit the technicians would receive hands-on practical training on how to apply the best practices trained.

Service companies will promote the participation of their technicians in the training course in order to certify them in CFC conservation management practices. The provision of a manual for CFC conservation and replacement servicing will help the mechanics to do their job properly. In order to receive the recovery equipment, service shops must have at least one of their technicians trained and certified in one of the training courses under the project.

The training programme will qualify service technicians to phase-out CFCs and prepare them for the future short term reduced availability of CFCs and the likely coming restriction, that PROZON may allow the sales of CFCs only to those who have been trained on proper handling of CFCs, etc.

6. MONITORING AND EVALUATION

The TFPs are serving also as reference information providers. Technicians can call or write and get support also after the training has finished. Through the provision of a few data points on their CFC consumption and practices they will benefit from this service. Thus, the training will acquire knowledge from the field and keep in touch with the technicians.

Once a year the TFPs will draw a sample of the trainees of the year and do field inspections in order to follow up the success of the training and eventual needs for improvement. This field visits will be also used to monitor the CFC use by the enterprises for countercheck of the general monitoring in the frame of the NPOP.

7. PUBLICITY CAMPAIGN

To help establishing the programme, an sectoral communication plan will be delivered showing the importance and the development of the project. This campaign also aims to reach the community to explain the importance of environmental protection.

To be successful, the campaign must reach the mechanics where they meet:

- Refrigeration contractors;
- Users of refrigeration equipment;
- The network of wholesalers and distributors for refrigeration and air conditioning equipment.

The retail stores will have a special role in the campaign since they are the meeting points for the mechanics and the personnel of the maintenance departments of the users companies. This will include the participation/advertising in local fairs and conferences.

At first all opinion builders will be mobilized. They will be the strategic force to reach the mechanics.

Secondly it is intended to start the distribution of materials and publications to draw the attention of the sector towards the project activities. This could include the distribution of an updated newsletter.

To accomplish that, all the publicity material will have an appeal for return. This way, it will be support the renewal of information until the project is completely implemented.

Altogether 12 stakeholder workshops will be organised on a regional level at the beginning of the training activities to ensure, that there is a positive participation and support from the industry and suppliers.

7. MANDATORY REGULATION

CONAMA Resolution No. 267 requires that during each and every process of removal of controlled substances from the place of its installation or in repair and maintenance workshops, the refrigerants must be appropriately collected, packaged and later sent to incineration centres or recycling units licensed by the competent environmental agency. In the absence of incinerators or recycling centres licensed by the competent environmental agency, the substances must be appropriately packaged in containers that meet the standards NBR 12,790 and NBR 12,791, or later standards.

While this may be intended to achieve a reduction in the consumption of CFCs in the service sector it will not be effective unless the refrigeration technicians in the service sector are appropriately trained and equipped. This legislation could be usefully improved including a requirement for refrigeration mechanics and technicians to be “Certified” following training in CFC management, conservation, and replacement.

9. TIMEFRAME

The project’s implementation schedule is presented in the Table below.

Project Implementation Schedule

Time Planning YEAR	2002	2003	2003	2004	2004	2005
Establishment of Project Coordination	xxxx					
Establishment of Contract with SENAI	xxx					
Selection of Trainers	xxx	xxx				
Didactic Material	xxxx					
Training Equipment Acquisition	xxxx					
Train the Trainer course	xxx		xxx			
Publicity Campaign	xxx	xxx	xx	xx	xx	
Mechanics Courses • Region 1 • Region 2 • Region 3 • Region 4 • Region 5		xxxxxxx xxxxxxx	xxxxxxx xxxxxxx x..xxxxx x..x..xxx ..x..x..x x	xxxxxxx xxx..x..x xxxxxxx xxxxxxx x..xxxxx xxxxxxx	xxxxxxx x x..x..x xxx..x..x xxxxx..x xxxxx..x	 x x .x.x
Project Management	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxxx

PROJECT COST CALCULATION

Calculation Basics	
Mechanics	60,000
Course Participation rate	0.667
Participants/course	16
Total amount of courses	2500
ODP Consumption in the sector	4938
Reduction Target	40%
ODP Tonnes phase out	1,975

10.1 International Expert			
Item	**Unit**	**Cost per Item**	**Total**
International expert as trainer	32	$450	$14,400
DSA for International expert as trainer	32	$350	$11,200
Preparation, Follow Up, Review Manuals	12	$450	$5,400
Flights	2	$7,000	$14,000
Total			**$45,000**

10.2 Cost of Trainer/ per Train the Trainer course			
Item	**Unit**	**Cost per Item**	**Total**
Trainer	13	$230	$2,990
Compensation for the institution	1	$500	$500
Manuals, Books, Literature	1	$100	$100
D SA	13	$70	$910
Consumables: Solder, refrigerants etc,	1	$100	$100
Flight/Travel cost	1	$300	$300
Total			**$4,900**

10,3 Cost per Technicians course				
Item	**Unit/Course**	**Cost per Item**	**Total**	**See Annex**
Trainer	3	$230	$690	
Compensation for Institution, Management/Administration	3	$100	$300	
Transport/Allowance	16	$30	$480	
Refreshments	16	$5	$80	
Consumables, solder, refrigerants etc,	16	$13	$208	3.2, 3.4
Manuals, Printmaterials, Examination documents	16	$15	$240	
Total			**$1,998**	

10.4 Costs for Training Equipment				
Equipment	**Units**	**Cost per Item**	**Total**	**See annex**
Demo Units	100	$950	$95,000	3.1
Main tools	50	$4,958	$247,900	3.3
Total			**$342,900**	

10.5 Promotional start up cost			
Item	**Units**	**Cost per Item**	**Total**
Sector communication Plan, introductory materials			$25,000
Regional stakeholder workshop 1WS/2 TFP	12	$14,000	$168,000
Total			**$193,000**

10.6 Monitoring and Evaluation			
Item	**Units**	**Cost per Item**	**Total**
Sampling	4	$5,400	$21,600
Data processing/reporting	2	$16,000	$32,000
SENAI Training/Counterpart/Coordinator	1		$60,000
Total			**$113,600**

10.7 Cost Summary			
Cost Item	**Units**	**Cost per Item**	**Total**
International expert	1	$45,000	$45,000
Train the Trainer workshops	50	$4,900	$245,000
Technician training courses	2500	$1,998	$4,995,000
Training equipment			$342,900
Promotional start up/workshop			$193,000
Monitoring			$113,600
Contingencies	10%		$34,290
Requested grant			**$5,968,790**
Support costs	10%		$596,879
Total cost to the MF			**$6,565,669**

ANNEX 1

Curricula for the train the trainers course

DAY	1st WEEK	2nd WEEK
1	Theory • Overview of the course • Refrigerants – new developments • lubricants • Blends • Oil blends	Demonstration unit Construction Components Take up operation Leakage proof Evacuation • Filling with refrigerant • Basic adjustments • Flange • Soldering Design of a presentation and examinations for participants
2	Laboratory • Design • Take up operation • Measuring Interpretation of results	Service: Maintenance and conservation of the units Cleanness Filling Dryer, observation glass Pe,I,U,p,t Lubricant test Measure protocol Unit condition Failure protocol Design of a presentation and examination for participants
3	Mobile Air Conditioners Design Specialities Retrofit from R12 to R134a • Robinair recycling units	Recovery Unit • Construction • Take into operation • Design of construction plan for bigger recovery units • Identification of refrigerants Design of presentation and examination for participants
4	Compressors Reciprocate compressors Compressors in climatization Design of a presentation and examines with participants	Retrofit: R12 to MP39/Fx56 Drop In Blend without lubricant exchange R12 to blend R290/R600a R12 to R134a, retrofit with lubricant exchange Design of presentation and examination for participants
5	Domestic Refrigerator • Capillaries • Retrofit from R12 to R134a	Continuing (Retrofit) Closing ceremony

ANNEX 2
Sample Curricula for a combination of technician modules

Module 1	Module 2	Module 4	Module 5
Theory Presentation: overview of Ozone Issues • refrigerants drop in and blends • lubricants • blends and their specific behaviour	**Exercise** Show at the demonstration units: • components • take up operation • leakage proof • evacuation • filling with refrigerant • basic adjustments • flange • soldering	**Exercise** 8 participants take the 4 units under guidance in operation, **Theory** working group with 4 participants: reciprocate compressor compressors in commercial units	**Theory/Exercise** Recuperation and recycling of refrigerants
Exercise 8 participants will run a service and failure protocol at the units, **Theory** workgroup with 4 participants: Drop In and Retrofit Recovery and Recycling	**Theory / Exercise** Presentation: • Retrofit a domestic fridge Exercise with the group: Replacement of compressor **Examine:** Service, error detection, Retrofit, Drop In, R&R	**Exercise** Retrofit the commercial units, **Examine:** Take in operation and compressors	**Theory** Presentation • Filling Unitary ComRef System • Retrofit Unitary ComRef System **Examine:** Unitary ComRef System service and R&R

ATTACHMENT 2.

CFC RECOVERY FROM DOMESTIC AND COMMERCIAL REFRIGERATION SYSTEMS AND EQUIPMENT DURING SERVICE & REPAIR ACTIVITIES

COUNTRY :		Brazil
SECTORS COVERED:		Domestic & Commercial Refrigeration Service
ODS CONSUMPTION IN AFFECTED SECTOR		4197 tons of CFC 12
PROJECT TITLE :		CFC RECOVERY FROM DOMESTIC AND COMMERCIAL REFRIGERATION SYSTEMS AND EQUIPMENT
PROJECT DURATION		3 years
PROPOSED BUDGET	Investment Costs	**US$ 6,520,800**
	Net Operational Costs	-
	Total Project Cost	**US$ 6,520,800**

IMPLEMENTING ENTERPRISE :
IMPLEMENTING AGENCY :
NATIONAL COORDINATING AGENCY :

PROJECT SUMMARY

This project is to enable CFC 12 recovery throughout Brazil in order to decrease CFC 12 consumption during the service of domestic and commercial refrigeration equipment, (and to permit subsequent recycling, or reclaim, of the recovered CFC 12 at regional refrigerant recycle and reclaim centres that are the subject of a separate investment project within the overall Brazil National CFC Phase-out Project).

Refrigeration service mechanics will be trained in the training project (another separate project within the overall Brazil National CFC Phase-out Project) to perform recovery operations, recharging of serviced equipment using "drop-in" refrigerants, as well as retrofit of CFC 12 based equipment to use zero-ODP refrigerants. This project will provide CFC 12 recovery and storage equipment to some 12,000 of the refrigeration mechanics that successfully complete the training programme for mechanics in the domestic and commercial refrigeration service sub-sectors. Mechanics will have to pay for the recovery and storage equipment using "Certificates" related to the value of the amounts of CFC 12 that they recover. This will result in reduced consumption of virgin CFC 12 in the refrigeration and air-conditioning service sectors, and assist Brazil in meeting its Montreal Protocol obligations and in achieving CFC 12 phase-out in 2007.

PROZON and UNDP, with the support of industry associations, will implement the project. A management structure will be established to supervise and monitor the project. The implementation of this project will be supported by specific legislation establishing the legal framework for the recovery recycling and reclaiming activities.

PROJECT OF THE GOVERNMENT OF BRAZIL

1. INTRODUCTION

The first action, regarding the adoption of a strategy for reducing CFC consumption in refrigeration and air conditioning service sector in Brazil, which took the form of a project presented in this document, is related to the implementation of a programme of training and certification of mechanics who are working in the maintenance and service of domestic and commercial refrigeration equipment and systems. The second action is related to the implementation of specific projects to replace and conserve CFC 12 through recovery, recycling and reclamation. This project is concerned to the implementation of a CFC 12 recovery system through the distribution of recovery and storage equipment to approximately 30% of the mechanics trained in the training programme.

This project is related to CFC 12 used as the refrigerant in the domestic and commercial refrigeration segment, including the self-contained products (vertical, chest-freezers and displays) and remote systems (food stores, bakeries, supermarkets, etc.).

The CFC recovered by the mechanics will be sent to recycling or reclamation stations to be treated in order to be able to be reused as refrigerant.

2. OBJECTIVES

The main goals of this project are the implementation of a system for CFC 12 Recovery and Management in the domestic and commercial refrigeration sectors in the several regions of Brazil through the distribution of 12,000 recovery machines and storage cylinders to 30% of the mechanics involved in the programme.

The implementation of this project will:

- Decrease the venting of CFC 12 to the atmosphere;
- Reduce the consumption of virgin CFC 12 during servicing;
- Help to prolong the working life of CFC based equipment as CFC availability is gradually reduced, and finally phased-out by CONAMA Resolution 267.

This project is intended to reach also the autonomous technicians that do not take part of any authorized shops network. Besides servicing self-contained equipment, these mechanics perform more activities in the commercial refrigeration (remote systems) segment than the mechanics that work for authorized shops. Because of the remote systems higher CFC load, it is very important to reach these mechanics.

3. PROJECT DESCRIPTION

The recovery and storage equipment will be purchased by PROZON/UNDP, and will be distributed to the technical assistance networks, shops and autonomous mechanics that will be responsible for their maintenance and for providing information about their use. If they fail in the appropriate use or in providing information about the equipment utilization, they will have to return the equipment, which will then be distributed to other selected users (assistance networks, shops and autonomous mechanics).

The mechanics and shops will have the opportunity to own the equipment by paying for the equipment using recovered CFC. For this purpose, they will have to bring the CFC

recovered to one company certified by PROZON/UNDP where they will receive certificates in R$, in the proportion to the amount of CFC, using the market price for CFC. The authorized companies will be selected and certified by PROZON/UNDP among wholesalers, refrigerant distributors and recycling/reclaiming companies. They will receive the recovered CFC and they will either send it to recycling companies or recycle it, in the case of recycling centres. The money that these companies will make selling the recovered CFC to a recycling company, or recycling and selling it to customers, will be kept by them as a payment for their work. That will be the economic incentive for them to participate in the programme

Mechanics will send their certificates to UNDP/PROZON, and will receive the document of ownership of the recovery and storage equipment after achieving the value of the equipment.

PROZON/UNDP, with the help of their partners and members of the institutional framework supporting the project, will be responsible for the project analysis, contracting, disbursement, management and evaluation, and will be responsible for monitoring the whole programme, PROZON will be responsible for gathering data and providing technical reports. To fulfil its role, PROZON will establish a data bank containing all the information about the project performance.

4. METHODOLOGY

The following equipment will be acquired and distributed to the refrigeration mechanics:

- 12,000 x recovery machines (small and medium size);
- 12,000 x 5 kg storage cylinders;
- 12,000 x 10 kg storage cylinders

The recovery machines will be bought by PROZON who will distribute them to selected mechanics and firms. They will be selected based on the following criteria:

- They have been certified as having completed the associated domestic and commercial refrigeration service mechanics training programme;
- The length of time they have been actively working as a refrigeration service mechanics;
- The number and type of refrigeration equipment and systems serviced monthly, the amount of CFC 12 consumed in service activities and, the potential quantity of CFC 12 that could be recovered.

These CFC 12 recovery machines will be used under the control of UNDP/PROZON, during the period of their payment by the mechanics, in order to ensure that the project goals are achieved. This procedure, selected as the more appropriated to the project, has the following benefits:

Monitoring of the equipment use. This activity will permit to collect important information, like amount of refrigerant recovered and sent to recycling/reclamation, by equipment, region, etc.;

- To keep equipment in use, independently of the interruption of activities of the small companies that are typical in this area of business;
- To keep the equipment in good condition, as the mechanics will be obligated by contract to do that.

In summary, the basic activity of this project will be:

CFC 12 recovery and storage by the mechanics during service operations using appropriated equipment and cylinders. The cylinders of recovered CFC 12 will be brought to the C*ertified Companies* by the mechanics, and they will receive *Certificates* in R$ related to the amount of recovered CFC 12. These *Certificates* will in turn be used by the mechanics to pay for the recovery and storage equipment, other than this the *Certificates* have no value.

After the payment of the recovery and storage equipment, the main driving force for the mechanics to continue to participate in the project recovering CFC and sending it to the treatment centres is the economical benefit. Considering the current price of virgin CFC 12 in the after-market is US$ 6.0/kg, and the predicted cost for the recycled/reclaimed CFC 12 is US$ 3.0/kg, the mechanics will raise their monthly income whenever they use recycled/reclaimed CFC 12 instead of virgin CFC 12.

This situation shows that the motivation for the refrigeration mechanics to recover CFC is present through an economic incentive. The low level of income of the refrigeration service mechanics in Brazil, which differs substantially from any country in the developed world, creates a further incentive.

Due to the size of the country, the strategy to be used is to develop the project by phases, following the implementation of the associated domestic and commercial refrigeration service mechanics training programme, and incorporating the regular evaluation of activities that will allow the necessary adjustments and improvements in the course of project implementation. In this way, the project will be implemented giving priority to the regions with the higher concentration of mechanics and highest levels of CFC 12 consumption.

Table 1 presents the estimated CFC consumption in the five geographical regions of Brazil

Table 1 Estimated Regional CFC Consumption in The Refrigeration and Air Conditioning Servicing Sector

Region	Estimated CFC 12 Consumption (ODP tons 2000)
NORTH	170
NORTH-EAST	811
SOUTH-EAST	2,465
SOUTH	546
CENTRE-WEST	205
TOTAL	**4,197**

Based on the distribution presented in table 1 and the criterion of developing the project in a regional approach, the sequence of the project implementation will be

1. **Region SOUTH-EAST**
2. **Region NORTH-EAST**
3. **Region SOUTH**
4. **Region CENTRE-WEST**
5. **Region NORTH**

Management is a key factor for the success of this project. The numbers of equipment items involved, and the complexity of the logistics, are strong indications of the importance of coordination in this project.

5. INSTITUTIONAL FRAMEWORK

PROZON and UNDP will be responsible for the coordination of the project. Other institutions like ABRAVA (Brazilian Association of Refrigeration, Air Conditioning and Heating) and ELETROS (Association of Domestic and Commercial Refrigerator and Freezer Manufacturers) can also assist in the development and implementation of the project.

6. CFC RECOVERY SYSTEM LOGISTICS

About 30% of the number of mechanics expected to be trained will receive the CFC 12 recovery and storage equipment. During refrigeration equipment service and repair three scenarios can take place:

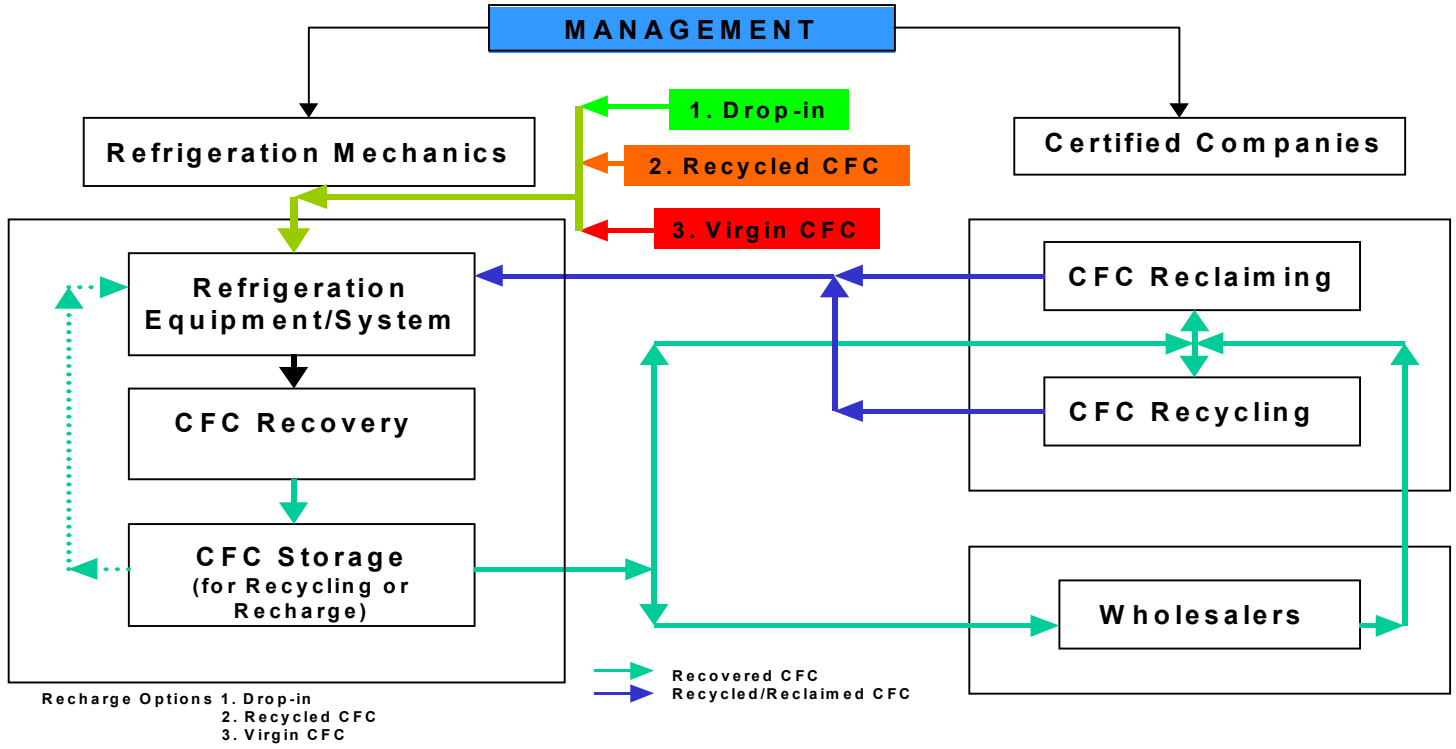
- The first possibility is that the service mechanic recovers the CFC 12 refrigerant from the system and then, after the repair of the equipment, recharges it with the same CFC 12. In this case, the mechanics, considering the characteristics of the system failure, should be sure the refrigerant is clean enough to be introduced back in the system.

- If the service mechanic considers that the refrigerant is not clean enough to be reintroduced in the system, or he wants to use the recovered CFC 12 to obtain *Certificates* for payment of the recovery and storage equipment, then his first option should be to recharge the system with a "drop-in" refrigerant. If for any reason this is not possible then the remaining options should be recharge with recycled/reclaimed CFC 12, or virgin CFC 12, strictly in that order.

- After having paid for his CFC 12 recovery and storage equipment the service mechanic can either recycle the recovered CFC by himself (if he has a recycling equipment), or take the refrigerant to a recycling centre to recycle it. The options for recharging the refrigeration equipment should be as above, namely first option should be a "drop-in" refrigerant, and if this is not possible then the remaining options strictly in order should be recharge with recycled/reclaimed CFC 12, or virgin CFC 12.

Figure 1 discloses the complete scheme for CFC management, separating the functions performed by the refrigeration mechanics, and the treatment facility. Project management will coordinate and monitor the various operations foreseen in the diagram.

Figure 1. CFC Recovery Project Organisation/Management Structure



7. MANDATORY REGULATION

CONAMA Resolution No. 267 of 14 September 2000 requires that during each and every process of removal of controlled substances from the place of its installation or in repair and maintenance workshops, the refrigerants must be appropriately collected, packaged and later sent to incineration centres or recycling units licensed by the competent environmental agency. In the absence of incinerators or recycling centres licensed by the competent environmental agency, the substances must be appropriately packaged in containers that meet the standards NBR 12,790 and NBR 12,791, or later standards.

While this may be intended to achieve a reduction in the consumption of CFCs in the service sector it will not be effective unless the refrigeration mechanics and technicians in the service sector are appropriately trained and equipped. This legislation could be usefully improved including a requirement for refrigeration mechanics and technicians to be "Certified" following training in CFC management, conservation, and replacement.

8. TIMEFRAME

The project's implementation schedule is presented in **Table 2**.

TABLE 2. PROJECT IMPLEMENTATION[2] SCHEDULE

	1st YEAR		2nd YEAR		3rd YEAR	
	1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem
Recovery machines and cylinders bidding process	xxxxxx	xxxxxx				
Selection of mechanics to receive equipment **Establishment of contract with mechanics**		xxx . xx	xxx xxx	xxx xxx	xxx xxx	xxx xxx
Supervision and monitoring	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxx	xxxxxx
Project Management	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx

[2] procurement, establishment, etc...

9. COSTS

Project costs are comprised of investment costs related to the recovery and storage equipment, and operational management costs.

9.1 Investment Costs

CFC 12 Recovery machines and components	
CFC 12 Recovery Machines	US$ 400 x 12,000= US$ 4,800,000
CFC 12 Storage Cylinders ***5 kg cylinders*** ***10 kg cylinders***	 US$ 37 x 12,000 = US$ 444,000 US$ 57 x 12,000= US$ 684,000
Sub-Total	**US$ 5,928,000**
Contingencies 10%	US$ 592,800
Total	**US$ 6,520,800**

10.2. Operational Costs

Management (personnel, office materials, and others)	To be included in the management cost for the NPOP implementation

TOTAL COST	**US$ 6,520,800**

ANNEX 1

TECHNICAL REVIEW

CFC RECOVERY FROM DOMESTIC AND COMMERCIAL REFRIGERATION SYSTEMS AND EQUIPMENT DURING SERVICE & REPAIR ACTIVITIES

ATTACHMENT 3.

ESTABLISHMENT OF 10 REGIONAL CFC 12 REFRIGERANT RECYCLING AND RECLAMATION CENTRES IN BRAZIL

COUNTRY :		Brazil
SECTORS COVERED :		Domestic & Commercial Refrigeration Service
ODS CONSUMPTION IN AFFECTED SECTOR :		4197 ton of CFC 12
PROJECT TITLE :		Establishment of 10 Regional CFC Recycling and Reclamation Centres in Brazil
PROJECT DURATION		2,5 years
PROPOSED BUDGET	Investment Costs	**US$ 3,880,000**
	Net Operational Costs	
	Total Project Cost	**US$ 3,880,000**

IMPLEMENTING AGENCY :
NATIONAL COORDINATING AGENCY :

PROJECT SUMMARY

This project is to establish 10 regional CFC 12 recycle and reclaim centres in key locations in Brazils largest cities to enable CFC 12 recovered during the service and repair of domestic and commercial refrigeration equipment and systems to be recycled/reclaimed for re-use.

This will reduce virgin CFC 12 consumption in the refrigeration and air-conditioning service sectors, and assist Brazil in meeting its Montreal Protocol obligations and in achieving CFC phase-out in 2007.

The project is directly related to two other projects in the Brazil National CFC Phase-out Project: the Training Programme for Refrigeration Mechanics in the Domestic and Commercial Refrigeration Service Sectors, and the Project for CFC Recovery from Domestic and Commercial refrigeration equipment and Systems during Service and Repair Activities. The training programme will prepare the refrigeration mechanics for the activities involved in CFC 12 refrigerant management, including recovery, recycling, reclaiming, and the CFC Recovery project will provide equipment to enable the trained mechanics to practice CFC 12 Recovery.

The implementation of this project will be supported by specific legislation establishing the legal framework for the recovery, recycling and reclaiming activities.

PROJECT OF THE GOVERNMENT OF BRAZIL

1. INTRODUCTION

Surveys conducted for preparation of the National CFC Phase-out Project indicate that some 4,945 ODP tons of CFCs were consumed in the refrigeration and air-conditioning service sectors in 2000. 4,197 ODP tons (85%) of this consumption was in the domestic and commercial refrigeration service sub-sectors. This consumption of CFCs includes the complete replacement, or top-up, of refrigerant losses during equipment operation, as well as the replacement of the refrigerant charge vented to atmosphere during service and repair activities. The use of CFC 12 for the purging of systems during repair, as well as the overcharging of refrigerant, is also believed to contribute to this consumption.

This consumption of 4,945 ODP tons of CFCs by the refrigeration and air-conditioning service sectors accounted for 53% of the total CFC consumption in Brazil in 2000. Over 99% (4,917 ODP tons) of the total of 4,945 ODP tons consumed was CFC 12.

The main reasons for the high level of CFC 12 consumption in the domestic and commercial, refrigeration service sub-sectors are:

- The low quality of maintenance and repair services;
- The deteriorated state of many of the refrigeration installations;
- The non-existence of refrigerant recovery, recycling and reclaiming practices;
- The lack of training, proper tools, and a lack of awareness of environmental issues at the service technician level.

2. OBJECTIVES

The main goals of this project are the implementation of a system for CFC 12 Recycling and Reclamation in Brazil based on the establishment of 10 regional centres in the Metropolitan Region of Brazil largest cities.

The regional CFC 12 Recycling and Reclamation Centres will include a processing facility to evaluate and monitor the quality of CFC 12 recovered in refrigeration and air conditioning systems and to perform recycling and reclaiming activities

This project proposal should be read in conjunction with the project proposal to provide some 12,000 *TRAINED* refrigeration service mechanics with CFC 12 recovery and storage equipment.

4. METHODOLOGY

Due to the size of the country, the strategy to be used is to develop the project by phases, following the implementation of the domestic and commercial refrigeration service technician training programme, and the CFC 12 recovery project, and incorporating the regular evaluation of activities that will allow the necessary adjustments and improvements in the course of project implementation. In this way, the project will be implemented giving priority to the regions with the higher concentration of mechanics and highest levels of CFC 12 consumption.

Table 1 presents the estimated CFC consumption in the five geographical regions of Brazil and the proposed number of recycling/reclaiming centres

Table 1 Estimated Regional CFC Consumption in the Refrigeration and Air Conditioning Servicing Sector and Proposed Number of Recycling/Reclaiming Centres

Region	Estimated CFC 12 Consumption (ODP tons 2000)	Proposed No. of Recycling/Reclaiming Centres	Cities
NORTH	170	1	Manaus
NORTH-EAST	811	2	Recife, Salvador
SOUTH-EAST	2,465	4	São Paulo Campinas Rio de Janeiro Belo Horizonte
SOUTH	546	2	Porto Alegre, Curitiba
CENTRE-WEST	205	1	Cuiabá
TOTAL	**4,197**	**10**	

Based on the distribution presented in table 1 and the criterion of developing the project in a regional approach, the sequence of the project implementation will be

1. **Region SOUTH-EAST**
2. **Region NORTH-EAST**
3. **Region SOUTH**
4. **Region CENTRE-WEST**
5. **Region NORTH**

5. INSTITUTIONAL FRAMEWORK

PROZON and UNDP will be responsible for the coordination of the project. Other institutions like ABRAVA (Brazilian Association of Refrigeration, Air Conditioning and Heating) and ELETROS (Association of Domestic and Commercial Refrigerator and Freezer Manufacturers) can also assist in the development and implementation of the project.

6. PROJECT DESCRIPTION

6.1 CFC Management System Logistics

About 30% of the number of mechanics predicted to be trained will receive CFC 12 recovery and storage equipment. During refrigeration equipment service and repair three scenarios can take place:

- The first possibility is that the service mechanic recovers the CFC 12 refrigerant from the system and then, after the repair of the equipment, recharges it with the same CFC 12. In this case, the mechanics, considering the characteristics of the system failure, should be sure the refrigerant is clean enough to be introduced back in the system.

- If the service mechanic considers that the refrigerant is not clean enough to be reintroduced in the system, or he wants to use the recovered CFC 12 to obtain *Certificates* for payment of the recovery and storage equipment, then his first option should be to recharge the system with a “drop-in” refrigerant. If for any reason this is not

possible then the remaining options should be recharge with recycled/reclaimed CFC 12, or virgin CFC 12, strictly in that order.

- After having paid for his CFC 12 recovery and storage equipment the service mechanic can either recycle the recovered CFC by himself (if he has a recycling equipment), or take the refrigerant to a recycling centre to recycle it. The options for recharging the refrigeration equipment should be as above, namely first option should be a "drop-in" refrigerant, and if this is not possible then the remaining options strictly in order should be recharge with recycled/reclaimed CFC 12, or virgin CFC 12.

Analysis of the recovered CFC 12 refrigerant enable the correct decision to either recycle, or reclaim, the recovered CFC 12..

Figure 1 discloses the complete scheme for CFC management, separating the functions performed by the refrigeration mechanics, and the treatment facility. Project management will coordinate and monitor the various operations foreseen in the diagram.

6.2 Refrigerant Treatment Facility

In each facility, the recovered CFC 12 refrigerant brought in by the mechanics will be treated through recycling or reclaiming.

Each recycle/reclaim facility will be equipped with the following items:

50 x cylinders of 60 kilograms
4 x tanks of 1 ton
2 x transfer machines
1 x gas chromatography unit for refrigerant analysis
2 x recycling machines and 2 reclaiming machines

In each facility, temporary storing and handling of the refrigerants will be done through the use of 4 tanks of 1 ton, 50 cylinders of 60 kilograms each and transfer machines. This will allow flexibility in all operations and will help organize the refrigerants according to its kind, origin and level of contamination.

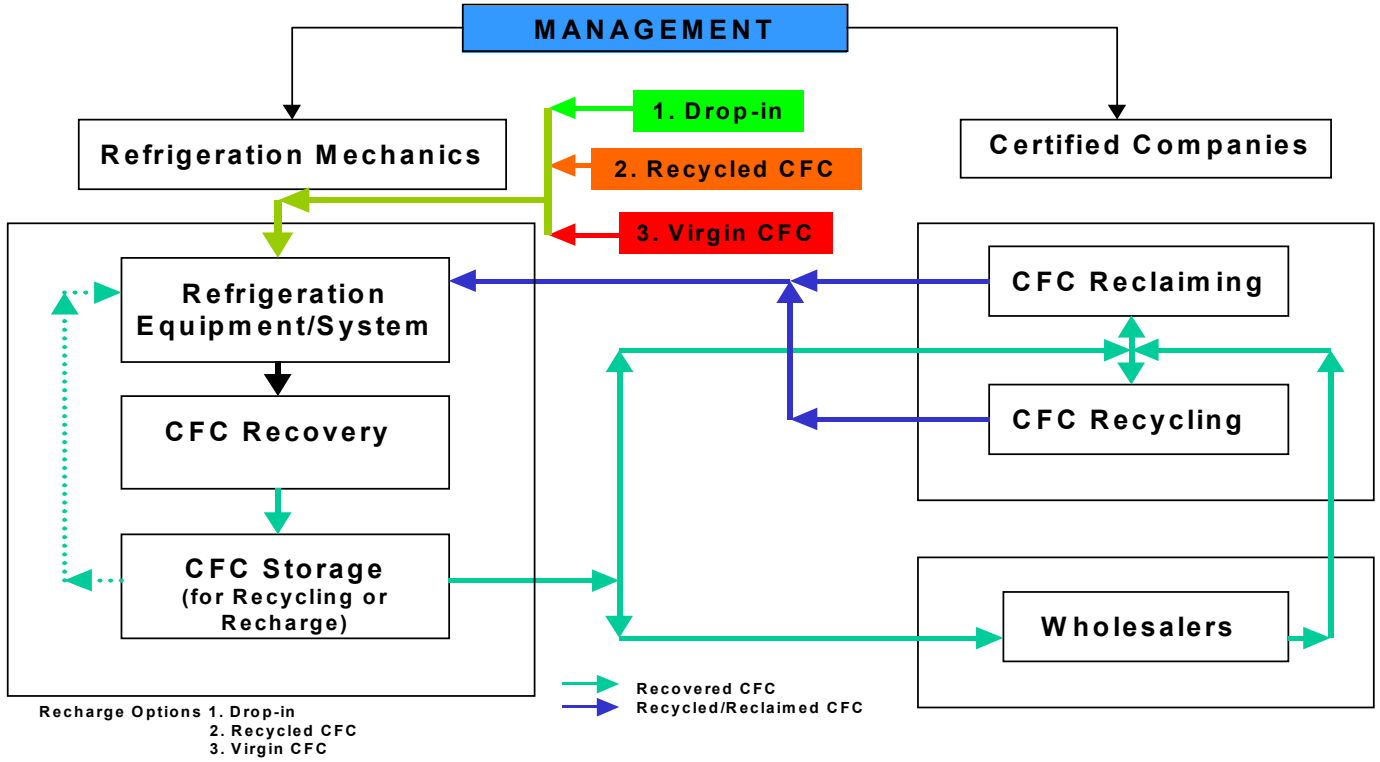
To collect this information it is necessary to have testing equipment capable of doing most of the chemical analysis of the refrigerant. This equipment is a gas chromatography unit and the kit of components that will provide the project with the desired data on the conditions of the recovered CFC 12 from systems.

6.3 Publicity Campaign

To help establish the project, an extensive public and sectoral communication plan will be delivered showing the importance and the development of the project. This campaign also aims to reach the community to explain the importance of environmental protection.

To be successful, the campaign must reach the mechanics where they are: refrigeration contractors, users of refrigeration, and the network of wholesalers and retailers for refrigeration and air conditioning industry. The retail stores will have a special role in the campaign since they are the meeting points for the mechanics and the personnel of the maintenance departments of the user companies.

Figure 1. CFC Recycle/Reclaim Project Organisation/Management Structure



7. MANDATORY REGULATION

CONAMA Resolution No. 267 of 14 September 2000 requires that during each and every process of removal of controlled substances from the place of its installation or in repair and maintenance workshops, the refrigerants must be appropriately collected, packaged and later sent to incineration centres or recycling units licensed by the competent environmental agency. In the absence of incinerators or recycling centres licensed by the competent environmental agency, the substances must be appropriately packaged in containers that meet the standards NBR 12,790 and NBR 12,791, or later standards.

While this may be intended to achieve a reduction in the consumption of CFCs in the service sector it will not be effective unless the refrigeration mechanics and technicians in the service sector are appropriately trained and equipped. This legislation could be usefully improved including a requirement for refrigeration mechanics and technicians to be "Certified" following training in CFC management, conservation, and replacement.

8. TIMEFRAME

The project implementation schedule is presented in Table 2.

Table 2 Project Time Frame

	1st YEAR		2nd YEAR		3rd YEAR	
	1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem
Processing Facility - Storage Cylinders - Manage Cylinders - Transfer Machines - Gas Chromatograph - Recycling Machines - Reclaiming Machine - Laboratory		xxxxxx xxxxxx xxxxxx xxxxxx xxxxxx xxxxxx xxxxxx				
Publicity Campaign	xxxx					
Project Management	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
Recovery System Operation[3]			xxxxxx	xxxxxx	xxxxxx	xxxxxx
Processing Facility Operation[4]			xxxxxx	xxxxxx	xxxxxx	xxxxxx

[3] mechanics activities
[4] refrigerant analysis, recycling, reclaiming

9. COSTS

9.1 Investment Costs

CFC 12 Recycle/Reclaim Centres	
Processing Facility	US$ 350,000 x 10 = US$ 3,500,000
Contingencies 10%	US$ 350,000
Publicity Campaign	US$ 30,000
Sub-total	**US$ 3,880,000**

10.2. Operational Costs

Management (personnel, office materials, and others)	To be included in the management cost for the NPOP implementation

TOTAL COST	**US$ 3,880,000**

ANNEX 1

TECHNICAL REVIEW

ESTABLISHMENT OF REGIONAL CFC 12 REFRIGERANT RECYCLING AND RECLAMATION CENTRES IN BRAZIL

ATTACHMENT 4.

INCENTIVE PROGRAMME FOR THE COMMERCIAL REFRIGERATION END-USER SECTOR

COUNTRY :		Brazil
SECTORS COVERED:		Commercial Refrigeration End-User Sector
ODS CONSUMPTION IN AFFECTED SECTOR		4197 tons of CFC 12
PROJECT TITLE :		INCENTIVE PROGRAMME FOR THE COMMERCIAL REFRIGERATION END-USER SECTOR
PROJECT DURATION		5 years
PROPOSED BUDGET	Investment Costs	**US$ 4,520,800**
	Net Operational Costs	-
	Total Project Cost	**US$ 4,520,800**

IMPLEMENTING AGENCY :
NATIONAL COORDINATING AGENCY :

PROJECT SUMMARY

The objective of this project is to eliminate CFC 12 consumption in the commercial refrigeration service sector by providing an incentive to end-user enterprises in the sector to encourage them to replace their existing CFC based refrigeration equipment with new equipment based on zero-ODP refrigerants, or to permanently retrofit their existing CFC based refrigeration equipment to use zero-ODP, or low-ODP refrigerants.

Incentive payments will be based on CFC consumption when equipment is replaced, or the cost of permanent retrofit & CFC consumption, and will range from US$ 400 - US$ 10,000.

The "Incentive Programme" will be publicized via National Workshops and by other means using ABRAVA, refrigeration equipment wholesales and distributors, equipment manufacturers, etc. Applications for the incentive payments will be sent to PROZON during the period 2003 - 2007.

PROZON will oversee this programme together with Agency assistance as required.

PROJECT OF THE GOVERNMENT OF BRAZIL

1. PROJECT OBJECTIVE & ELIGIBILITY

The objective of the Incentive Programme Project is to eliminate as much as possible of the consumption of CFC 12 in the commercial refrigeration service sector through the payment of a financial incentive to end-user enterprises in the sector that have existing refrigeration equipment that uses CFC 12 refrigerant. Such enterprises will be eligible to apply for an Incentive Payment if:

They replace the existing refrigeration equipment with new equipment that uses a refrigerant that is not an Ozone Depleting Substance (e.g. R134a or R404A, R507, R290, R600, R600a, Ammonia, etc.), or that uses a refrigerant that has only a small potential to deplete the Ozone Layer (e.g. R22,).

or

They permanently retrofit the existing refrigeration equipment to use a refrigerant that is not an Ozone Depleting Substance (e.g. R134a or R404A, R507, R290, R600, R600a, Ammonia, etc.), or that uses a refrigerant that has only a small potential to deplete the Ozone Layer (e.g. R22).

The duration of this programme is extended throughout 2007. Any enterprise that wishes to come forward with a request for an incentive, can do so whenever they decide to replace, or retrofit, their CFC 12 refrigeration system, and can do so between 2003 and 2007. However, as the incentive programme will be operated on a first come, first served basis, it is expected that it will lead to early reductions in CFC consumption.

2. SECTOR BACKGROUND

Consumption of CFC 12 for service in the commercial refrigeration sector in 2000 was estimated as 3,297 ODP tons. There was no reported consumption of CFC 11, or R502, in the sector.

Commercial refrigeration systems and equipment in Brazil have a life expectancy of between 10 and 15 years. Large numbers of commercial refrigeration systems and equipment based on CFC 12 refrigerant were still being produced in Brazil in 1999, and even today there remains some small volume production based on CFC 12.

In 2007, after Brazil phases-out virgin CFC consumption, there will still then be a significant population of CFC 12 based commercial refrigeration systems and equipment in operation that, under normal circumstances, would require charging with CFC 12 following repairs. The majority of such commercial refrigeration systems and equipment would have been retired by 2014, with only a small number perhaps having useful lifetimes up to 2017.

This conclusion is based on the typical lifetimes of the installed systems and equipment in the commercial refrigeration sector. While the demand for CFC 12 should now start to start to decline, the rate of replacement of old equipment will be slowed by the adverse economic situation currently faced by the Brazilian industry, and the working life of existing equipment may be forcibly extended. This is a recipe for increased consumption of CFC 12 for servicing bearing in mind the existing state of the service sector.

In order to comply with its CFC consumption obligations under the Montreal Protocol, Brazil has already introduced CFC 12 import quota legislation that will progressively reduce the

levels of CFC 12 consumption to zero by 01 January 2007, Given this scenario, the remaining lifetime of installed equipment, and the very high level of CFC 12 for service and repair activities in the commercial refrigeration sector, action such as the proposed incentive programme is urgently required in order to reduce the economic impact on the country.

This project aims at eliminating around 200 ODP tons of CFC 12 consumption in the commercial refrigeration sector by incentive payments to end-users to replace, or retrofit, their equipment to use zero-ODP, or low-ODP, refrigerants.

The following general observations are relevant to the installed equipment in the commercial refrigeration sector in Brazil:

- Many of the facilities are equipped with separated condensing and evaporating units.
- Some of the larger installations are reasonably well maintained and a conversion to zero-ODP, or low-ODP refrigerants would require relatively minor changes, other installations would need to be completely re-built or replaced.
- Some newer installations are using CFC refrigerants. The retrofit of these installations to zero-ODP, or low-ODP refrigerants will be relatively easy since these installations were designed for use with either CFC or HFC refrigerants.
- Retrofit to use a hydrocarbon refrigerant, if applicable, would involve some equipment re-design, and upgrading of the electrical installation. In the case that a zero-ODP flammable hydrocarbon refrigerant was the preferred choice to replace the existing CFC refrigerant, equipment replacement, rather than retrofit, would likely be the more cost-effective option.

3. GENERAL JUSTIFICATION FOR A REFRIGERATION END-USER PROJECT

A decision was taken at the 28th Meeting of the Executive Committee, providing guidance on this new sub sector (Decision 28/44). The conditions to be met and Brazil's compliance with these conditions can be summarised as follows:

1) That the country has production and import controls on CFCs and CFC based equipment in place and effectively enforced, and restricts the deployment of new CFC components; - ***Brazil has CONAMA Resolution No. 267 of 14 September 2000 that covers these requirements.***

2) That at the time of seeking compensation in the form of grants for end-user conversions, the country can establish that its major remaining consumption is for the servicing of refrigeration and air-conditioning equipment; - ***The 3,290 ODP tons of CFC 12 in the commercial refrigeration service sector represents 59% of the remaining CFC 12 eligible for funding under Decision 35/57.***

3) To establish the above, a comprehensive data on the profile of all remaining consumption has been determined and made available to the Executive Committee; - ***A breakdown of CFC consumption is presented within the Brazil National CFC Phase-out Project proposal.***

4) That either no other possible activities would allow the country to meet its CFC control obligations, or the comparative consumer price of CFCs, relative to substitute refrigerants, has been high for at least 9 months and is predicted to continue to increase. ***- This project proposal forms part of the strategy to eliminate CFC 12 consumption in the commercial refrigeration service sector as proposed in the Brazil National***

CFC Phase-out Project proposal. The price of CFC 12 has almost doubled in the past 6 months.

4. TECHNOLOGY OVERVIEW

The following three options to eliminate CFC 12 consumption are potentially available to an end-user in the commercial and industrial refrigeration sector:

1. Replacement of the existing CFC 12 based refrigeration system with a system designed to use a zero-ODP, or low-ODP refrigerant. This option requires a major investment in new equipment. New equipment based on zero-ODP refrigerants such as HFC-134a, R-404A, R-507, hydrocarbons – R-290, R-600, R-600a, and mixtures thereof, or ammonia, is commercially available and all can be considered as "once off" permanent replacement with no further change in refrigerant necessary for the lifetime of the equipment. New equipment based on the use of a low-ODP HCFC refrigerant such as HCFC-22 is also commercially available. Whilst this may currently be an environmentally acceptable solution, it should be regarded as an interim solution that will require a further change to a zero-ODP refrigerant at some future date.

2. Retrofit of existing refrigeration equipment to use a zero-ODP refrigerant. This option that will prolong the useful lifetime of the existing equipment is technically feasible for some, but not all, existing equipment. The age of the equipment, and the economics of retrofit versus replacement must be considered. The retrofit option should only be selected if the evaluation of the initial cost and operational costs over the anticipated remaining lifetime of the equipment is substantially lower than the initial and operating costs of a new installation. For newer equipment, the initial cost of the retrofit option should be quite low as such equipment is usually designed for use with either CFC or HFC refrigerants and the procedure is thus simplified. Retrofit from a CFC 12 refrigerant to a zero-ODP refrigerant such as HFC-134a, R-404A, R-507, or a hydrocarbon, may be regarded as a "once off" permanent solution with no further conversion of refrigerant necessary during the lifetime of the equipment.

3. Drop-in Ternary Blend Replacement Refrigerants containing HCFCs. The objective of this option is also to prolong the useful lifetime of the existing equipment but at lower initial cost. This can be achieved in some equipment by the use of ternary refrigerant blends typically containing HCFCs and HFCs, and sometimes Hydrocarbons. Blends with different properties are available to replace CFC 12, R500, and R502 over a wide range of operating conditions. However, in some equipment the use of these blends will also require similar system changes as in retrofit, namely a change of compressor oil and the filter dryer, and adjustment or replacement of the expansion device. Whilst the lower initial cost than retrofit to a HFC refrigerant for some equipment may be attractive, both the operating cost and availability of the refrigerant blend must be considered. Conversion from a CFC refrigerant to a low-ODP refrigerant blend that contains HCFCs must also be considered as an "interim" conversion that will require a further change to a zero-ODP refrigerant at some future date.

It should also be noted that by definition a "drop-in" refrigerant implies minimal system changes and little more than simple replacement of one refrigerant with another. In this case the conversion can easily be reversed and the elimination of CFC consumption may not be sustained.

In conclusion and under the circumstances facing end-users in the commercial refrigeration sector in Brazil over the next 5 years, both the equipment replacement option, and the permanent retrofit option to convert a CFC based refrigeration system to use a zero-ODP refrigerant will be a technically, environmentally, and sound financial proposition at a number of end-user enterprises. Because of the relative low cost and the question of sustainability, the replacement of CFC 12 by "drop-in" refrigerants based on ternary blends containing HCFCs is not considered eligible for assistance under this incentive programme.

5. PROJECT DESCRIPTION

Under this project any commercial refrigeration end-user enterprise that decides to replace, or retrofit its existing CFC 12 based refrigeration equipment can apply to receive an incentive payment towards the cost of the replacement equipment, or retrofit. Only enterprises that select replacement equipment, or retrofit based on non-CFC refrigerant technology would be eligible to receive an incentive payment.

The two components of the project are:

- Information dissemination and monitoring activities.
- Incentive programme.

The first component focuses on informing the end-users in Brazil about the existence of the incentive programme and follow up on applications for incentives received from them. Activities will include:

- Placement of advertisements in newspapers.
- Printing of information leaflets about the programme to be distributed to end-users by mail and by other means using ABRAVA, refrigeration equipment wholesales and distributors, equipment manufacturers, etc.
- Organising Regional Workshops targeting the end-users to advise them about the programme.
- Review and evaluation of the applications received by end-users
- Annual reviews of the progress of the programme

The second component consists of the grant incentives to be provided to end-users applying for an incentive payment. The conditions whereby end-users may receive an incentive payment and the calculation of the grant amount are given in the following section of the document.

6. CONDITIONS TO BE MET TO RECEIVE AN INCENTIVE PAYMENT.

1. Sector. The enterprise must belong to the commercial refrigeration end-user sub-sector. This sub-sector includes refrigeration systems used in food-storage (cold stores and silos), fisheries, meat-processing plants, breweries, hospitals, hotels, restaurants, supermarkets, refrigerated transport (trucks, rail, boats), etc. Enterprises with air-conditioning, MAC, are not included in this programme.

2. ODS and Alternatives. The eligible Ozone Depleting Substances (ODS) to be eliminated under this programme are CFC 12 and R502. Commercial refrigeration end-user enterprises that will be considered under this incentive payment project will therefore have to replace, or retrofit their existing CFC 12 or R502 based refrigeration system with a non-CFC refrigerant-based system. The use of drop-in refrigerant will not be considered for an incentive payment.

End-user enterprises will have a choice regarding which alternative non-CFC refrigerant-based technology they choose but the choice is limited to zero-ODP systems, or systems using simple HCFCs.

3. Duration and Modality. The programme may run during a period of five years (2003-2007). This duration could be shorter if the total funding of the incentive programme is exhausted before 2007. Enterprises, which send an application for a grant incentive, will be evaluated on a first-come first-served basis. Applications will be addressed to PROZON. A National Consultant will technically evaluate the applications. Any enterprise can only apply once during the five-year period, even if it has several refrigeration systems. However, an enterprise can combine several of its systems in its request for an incentive.

4. Eligibility. Enterprises will only be eligible if they were in existence before 25 July 1995 (Ref, Decision 17/7 of the Executive Committee of the Multilateral Fund.). Proof of this must be attached to the application, together a letter certifying that the refrigeration equipment was in operation during the last 3 years.

An end-user enterprise wishing to apply for an incentive payment will have to include the following information in its application for an incentive payment:

- Details of the proposed conversion, which must be based on proven and mature technology.
- Details of the costs of the proposed equipment replacement, or retrofit.
- Details of the costs of the current CFC refrigerant, and the proposed replacement refrigerant.
- Confirmation that it can meet established local and international safety, health, and environmental standards related to the new refrigerant.

(Note: Where existing equipment is to be replaced, the new equipment supplier will be expected to provide full technical support, and to provide all the required information on issues relating to safety, health, and the environment, during normal operation and emergency situations. Similar information in the form of Material Safety Data Sheets will be expected to be provided by the refrigerant supplier for conversions involving both equipment replacement, and retrofit.)

5. CFC Consumption. Applications must also contain information which establishes the average of the annual CFC (CFC or R502) consumption "C" over the last 3 years, and invoices showing this CFC consumption must be attached to the application. The ODP of CFC 12 is 1.0, while the ODP of R502 is 0.34. For this reason, the consumption will be calculated as

"C" = "Average CFC Consumption" + 0.34 x "Average R-502 Consumption"

The yearly consumption data of the refrigerant in kilograms must be presented by the enterprise making the application using the following example format, and clearly indicating the refrigerant involved (R12, or R502):

(R12) REFRIGERANT CONSUMPTION DURING LAST 3 YEARS				
Year	(a) Opening Stock 01 January in Kilograms	(b) Purchases during the Year in Kilograms	(c) Closing Stock 31 December in Kilograms	(a) + (b) – (c) Annual Consumption in Kilograms
(2000)				
(2001)				
(2002)				
TOTAL CONSUMPTION LAST 3 YEARS				
AVERAGE CONSUMPTION LAST 3 YEARS (TOTAL CONSUMPTION/3)				

6. Baseline Equipment. Applications must contain sufficient information describing the current refrigeration equipment at the end-user enterprise. This description should include as much as information as possible concerning the nature of the equipment, model, brand, year that the equipment was installed, as well as the price at purchase, serial number, capacity, CFC-charge, etc. Copies of the purchase order and invoice should be attached to the application, if available.

7. Recovery & Recycling of the CFC 12 Refrigerant Charges in the Baseline Equipment. The CFC 12 refrigerant charge in the existing equipment that is to be replaced, or retrofitted, must be recovered, and recycled. This will be co-coordinated with PROZON.

8. Conditions and determining the Grant "G".
The grant "G" that will be paid to the applicant depends on the consumption "C" as determined in 5. above. It will be derived from the following table:

Average Annual Consumption "C" for Service & Repair of the Replaced, or Retrofitted, Equipment in ODP Kg	PRO-RATED Scale of Eligible Incentive Payment In US$
20 - 50	400 - 1,000
50 - 100	1,000 - 2,000
100 - 200	2,000 - 5,000
200 - 300	5,000 – 7,500
300 - 400	7,500 - 10,000
>400	10,000

Following completion of the conversion, invoices must be produced by the end-user enterprise to confirm the total costs incurred by the enterprise during the conversion process involving either equipment replacement, or retrofit. These invoices will relate to the purchase of capital cost items, to local works carried out by the enterprise, the cost of the initial charge of the replacement compressor lube oil, and to the cost of the initial new charge of the replacement refrigerant and leak testing.

The complete cost data submitted by the enterprises to PROZON will be reviewed by the National Consultant who shall ensure that all of the required information has been provided. The National Consultant, shall then make a formal recommendation on the eligible level of the incentive payment to PROZON.

To receive the full incentive payment, an end-user enterprise must be able to demonstrate total costs for the conversion that exceed the incentive payment as calculated based on the CFC consumption and as described above. In the case that the total costs for the conversion are less than the incentive payment as calculated based on the CFC consumption, then the incentive payment to the enterprise will be limited to the verified eligible costs incurred in the conversion.

It should also be noted that the amount "G" is based on 100% Article-5 Country ownership. Funds for part Article-5 Country ownership will be reduced according to the percentage of Article-5 Country ownership of the enterprise.

9. Payment Modality and Destruction of Equipment.
After receipt of the required supporting documentation and approval of the application, up to 40% of the eligible incentive payment can be paid up front to the enterprise.

The eligible balance will only be paid after the existing CFC based equipment has been replaced, or permanently retrofitted, the total cost data has been reviewed and the National Consultant has made a formal recommendation on the actual level of the incentive payment, and formal certification that the existing CFC based equipment that was replaced has been destroyed/dismantled/rendered unusable with CFCs according to MLF policy decisions and guidelines.

Upon payment of the incentive, the enterprise will sign a statement confirming that it will no longer use CFC refrigerants in the equipment covered by the project

10. Post Project Monitoring.
PROZON may sporadically conduct post-monitoring visits to enterprises that have received an incentive payment, to ensure that the enterprise does not return to the use of CFC refrigerants.

7. PROJECT COSTS

PROJECT BUDGET	US$
National Consultant to provide overall guidance, prepare materials and participate in workshops to publicise project, evaluate applications for incentive payments, follow up on these with the end-user enterprise, final inspections of completed works, certification of completion and destruction of replaced equipment, final review of documents and recommendations relating to the level of incentive payment, monitoring activities, etc. (4 years)	100,000
National Workshops for informing End-Users (5)	30,000
Local Travel within the country	40,000
Publicity materials and activities, documentation for applications, newspaper ads, etc.	10,000
Incentives to the End-Users	4,000,000
TOTAL COST	**4,180,000**

8. PROJECT IMPLEMENTATION AND MONITORING

Year	2003				2004				2005				2006				2007			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Contract Consultant	X																			
Publicity & National End-User Workshops		X	X																	
Incentive Programme Running		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Project Review				X				X				X				X				X
Project completed																				X

ATTACHMENT 5.

NATIONAL PROGRAMME FOR RECOVERY & RECYCLING OF CFC 12 REFRIGERANT IN THE MOBILE AIR-CONDITIONING SERVICE SECTOR

COUNTRY :	Brazil
SECTORS COVERED :	Mobile Air-conditioning (MAC) Service
ODS CONSUMPTION IN AFFECTED SECTOR :	660 ODP tons of CFC 12
PROJECT TITLE :	National Programme for Recovery & Recycling of CFC 12 Refrigerant in the Mobile Air-conditioning Service Sector
PROJECT DURATION	3.5 years

PROPOSED BUDGET	Investment Costs	**US$ 1,976,400**
	Net Operational Costs	**-**
	Total Project Cost	**US$ 1,976,400**

IMPLEMENTING AGENCY :
NATIONAL COORDINATING AGENCY :

PROJECT SUMMARY

This project is to implement a nation-wide CFC 12 Refrigerant Recovery and Recycling (R&R) Programme for the Mobile Air Conditioning (MAC) service sub-sector. With rapidly declining availability of CFC 12, this project aims to prolong the useful working lifetimes of CFC based MAC systems by eliminating the deliberate emissions of CFC 12 during MAC servicing through a comprehensive National MAC Recovery and Recycling Programme covering all private and public transport.

15 Training Workshops for MAC service technicians and mechanics will be held to familiarise them with the MAC R&R Programme and to train those provided with equipment, through the project, in the recovery and recycling of CFC 12 refrigerant during the service of MAC systems. The Workshops will emphasise the good practices needed in the handling of refrigerants during the servicing of MAC systems and the project will provide 450 MAC recovery/recycling machines and ancillary equipment to the selected enterprises in the MAC service sub-sector that consume CFC 12 refrigerant.

PROZON will oversee this programme together with Agency assistance and a National Consultant to monitor the quantity and quality of the CFC 12 recycled.

PROJECT OF THE GOVERNMENT OF BRAZIL

1. OBJECTIVES

The objective of the project is to implement a comprehensive National Programme for the Recovery and Recycling (R&R) of CFC 12 refrigerant for the entire Mobile Air Conditioning (MAC) service sub-sector during the servicing of all forms of private and public transport (cars, light vehicles, buses, coaches, trucks, etc.).

2. SECTOR BACKGROUND

In 2000, Brazil consumed 5,669 ODP tons of CFC 12, of which 4,910 ODP tons was in the refrigeration service sector. This included an estimated total of 660 ODP tons of CFC 12 consumed in the service of mobile air-conditioning (MAC) systems in all forms of private and public transport. This consumption of 660 ODP tons of CFC 12 in the MAC service sub-sector is due to a number of reasons including the replacement of lost refrigerant charges, total or partial, resulting from system leaks, the purposeful venting of the refrigerant charge during servicing activities, such as maintenance, leak detecting and the cleaning of MAC systems.

Legislation prohibited the installation of CFC 12 based MAC systems “in new models launched after 01 January 1997”, and from 01 January 2001 “in all new models”. Though the local car manufacturers started to fit HFC 134a based MAC systems in their new cars in 1996, the after-market sector continued both to fit and to service CFC 12 based MAC systems due the lower cost of both CFC 12 and CFC 12 based MAC systems versus the relatively high cost of HFC 134a and HFC 134a based systems. CFC 12 was also readily available.

According to SINDIREPA, The Union of Automobile Repair Enterprises, there were 172,000 automobile repair shops in Brazil in 1998. According to FENABRAVE, National Federation of Authorised Vehicle Dealers, there were 4,500 Authorised Vehicle Dealers (AVD) in 1999. FENABRAVE have also stated that 48% of AVD were servicing MAC in 1999. A survey conducted in 1999, to obtain background data for this project, indicated that, of the AVD currently servicing MAC, over 7% are servicing a minimum of 60 vehicles/month and are consuming a minimum of 60 kg/month of CFC 12 with an average of 780 kg/year. According to estimates from manufacturers and distributors of MAC equipment in Brazil, 1% of the remaining automobile repair shops service MAC and that, of these, 400 are specialised MAC Centres. All of the specialised MAC Centres that have participated in the survey, are consuming a minimum of 60 kg/month of CFC 12 with an average of over 1,728 kg/year.

It is estimated that throughout Brazil there are at least 3,900 enterprises dealing in the servicing of MAC in cars and light vehicles. As only a very small proportion of the vehicle mechanics working in the MAC servicing sector have any technical knowledge of or formal training in refrigeration or air conditioning theory, it is normal practice for MAC servicing to be performed as a general vehicle maintenance or repair activity and to be carried out either following a vehicle manufacturer’s instruction manual or relying upon empirical knowledge, even in the specialised MAC Centres.

It is the general practice of MAC service personnel to vent the total of the remaining refrigerant charge before or during repairs, “retrofitting” and the dismantling of redundant equipment and after or during service practices, such as cleaning A/C circuits and leak detection. The survey indicates that only 3.17% CFC 12 refrigerant consumed by the MAC service sector in 1999 was being recovered and recycled.

In 2000, it is estimated that there remained a population of around 2.5 million CFC 12 based MAC systems, many of which had an anticipated remaining lifetime of at least 7 years.

3. PROJECT JUSTIFICATION

The strategy by the Government of Brazil relating to CFCs and its obligations under the Montreal Protocol is to reduce CFC 12 consumption rapidly during the period 2001 – 2006 before phase-out by 01 January 2007. With rapidly declining availability of CFC 12, this project aims to prolong the useful working lifetimes of CFC based MAC systems by eliminating the deliberate emissions of CFC 12 during MAC servicing through a comprehensive National MAC Recovery and Recycling Programme covering all private and public transport. This project is designed to implement such a programme and it includes the purchase of the relevant equipment and the familiarising of those vehicle mechanics and MAC technicians participating in the programme with good MAC maintenance and servicing practices, particularly the methods and technologies for the recovery and recycling of refrigerants.

Owners of CFC 12 based MAC systems will need a supply of CFC refrigerant over the next 7 – 10 years in order to maintain the systems operational without the costly need to retrofit, or replace them. It is then essential that a nation-wide infrastructure for the recovery and recycling of CFC 12 refrigerant in the MAC service sub-sector be put in place as soon as possible.

This R&R Project will permit the MAC service sector to face the most immediate consequences of the restrictions in the supply of virgin CFC 12, and it will allow Brazil to continue to maintain, for a further period of time, the presently installed CFC 12 based MAC systems which, for economic or technical reasons, can not be scrapped or “retrofitted” to use alternative refrigerants.

The equipment that will be supplied within the Project will permit the reuse of the 182 ODP tonnes of CFC 12 refrigerant that is expected to be recovered and recycled.

The proposed R&R Project would provide 450 MAC recovery/recycling machines and the necessary ancillary equipment to enterprises servicing cars, light vehicle, and other major MAC installations in Brazil.

It should be noted that this reduction in emissions does not include the quantities of CFC 12 which will not be vented in the future, due to the better servicing practices emphasised during the seminars (leak detection, cleaning, etc.).

4. PROJECT MONITORING

To ensure the success of the R&R Programme, PROZON in its capacity as co-ordinator of all activities related to the Montreal Protocol, will take overall responsibility for a comprehensive monitoring system.

Owing to the size and technical complexity of the Programme, a National Consultant will be contracted, within the Project, to perform the monitoring of the correct use of the equipment and the amounts of CFC 12 refrigerant recycled. The monitoring will be based on a computer database, which the consultant will set up, to record the amounts of refrigerant being recovered and recycled by each of the recipients of the MAC R&R machines which will be provided through this project. The participants will be expected to inform the consultant of these results on a monthly basis. If results are not disclosed, the consultant will contact and, if felt necessary and after informing PROZON, visit the participant concerned. If the consultant has grounds to believe that the equipment is not being used correctly within the terms of the Project, he or she will recommend to PROZON that the equipment be repossessed and allocated to a more suitable applicant. The consultant will also be responsible for seeing that the participants change the process filters according to the

equipment manufacturers recommendations and for assuring the quality of the recycled refrigerant.

Owing to the large number of participants and the large geographical area of Brazil, the National Consultant would be contracted on a full time basis for the duration of the programme. The consultant contracted to monitor the R&R programme, apart from keeping a record of the amounts recovered and recycled by the participants, will be expected to visit the participant's installations, at least once during the programme's duration, prepare periodical reports on the programme's progress and draft a final review.

The costs for this activity, including the purchase of a laptop computer, the fees of the National Consultant, travel expenses, DSA, office material, etc., are considered a direct and integral part of the R&R programme and are incorporated into the overall Project Budget.

All those receiving recovery or recycling equipment through the project will be expected to sign a contract with PROZON which will detail the equipment received and which will state the use to which this will be put. The contract will include a clause allowing the equipment to be repossessed in defined cases, such as, where the equipment is found to be being put to a use other than that stated, where the equipment is found to have been purposefully damaged or otherwise tampered with, failure to report the amounts recovered and recycled or if a stipulated quantity of CFC 12 refrigerant is not recovered or recycled over a given period.

5. PROJECT ACTIVITIES

5.1 ACTIVITY 1: TRAINING SEMINARS ON REFRIGERANT RECOVER AND RECYCLING AND GOOD MAINTENANCE PRACTICES FOR MOBILE AIR CONDITIONING.

A total of 15 training seminars will be conducted in 12 of Brazil's principle cities before the MAC R&R equipment is distributed to the programme's selected participants. The cities have been chosen because of the amount of automobiles registered in the area and because their situation will allow access to a maximum of MAC servicing enterprises based in outlying areas. The selected cities will include Brasilia, Belem, Fortaleza, Recife, Salvador, Bello Horizonte, Rio de Janeiro, Campinas, Ribeirao Preto, Sao Paulo, Curitiba and Porto Alegro. The preparation, organisation and implementation of the seminars will be the responsibility of PROZON. The seminars will be directed at the MAC technicians and vehicle mechanics of enterprises maintaining and servicing air conditioning units in the private and public transport sectors, as well as refrigeration teaching staff from vocational training institutions. This training will assure the effective use of all of the equipment supplied.

Though the training seminars will not necessarily be restricted to those receiving equipment under the programme, it will be obligatory for at least one senior service person from each of the participant enterprises to attend one of the training seminars. An attendance certificate will be presented to the participants at the end of each seminar.

Each of the training seminars will be conducted by a National Recovery/Recycling Expert. The seminars will be presided over by a representative of PROZON, who will give an introduction and an explanation of how the R&R programme will be implemented and monitored. Each seminar will be of one day duration and will include the background to the Montreal Protocol, an explanation of the problem of Ozone Level Depletion and the resultant need for recovery and recycling of CFC refrigerants, the presentation of recovery and recycling technologies and methodologies in different MAC systems, good practice during

servicing and maintenance of these, as well as a practical demonstration of the equipment to be supplied through the project.

Apart from the representative of PROZON and the National Recovery/Recycling Expert, the National Consultant responsible for the monitoring activities will also attend the seminars, plus an administrative assistant who will be responsible for the reception of the participants and the general administration tasks.

The seminars will utilise the Good Practices Manual prepared by UNEP.

5.2 ACTIVITY 2: CREATION OF A NATIONAL MAC RECOVERY AND RECYCLING NETWORK

Based on the present needs of Brazil, the Government has decided to establish the R&R network with 450 MAC recovery/recycling machines. The fact, that the machines recycle the refrigerant which is recovered and are not dependent upon a centralised facility, allows these to be extensively distributed throughout the country and to assure that any area, where a significant amount of MAC servicing is conducted, will have a corresponding amount of MAC recovery/recycling equipment.

5.3 ACTIVITY 3: DISTRIBUTION OF THE R&R EQUIPMENT

The programme's participants will have been selected, and their willingness to participate in the programme under the conditions stipulated by PROZON will be assured, before the Training Seminars commence.

An appropriate number of R&R machines and equipment will be transported by road, along with the demonstration equipment, to the venues of each of the Training Seminars and these will be handed over to the representatives of the participating enterprises on successful completion of the appointed operator's instruction.

5.4 ACTIVITY 4: MONITORING SYSTEM

As mentioned in paragraph 4, PROZON will take responsibility for ensuring a proper follow-up and monitoring of the recovery and recycling activities. A National Consultant will be contracted, with project funds, to keep independent records of the amounts of CFC 12 recovered and recycled by each of the MAC R&R machines and to assure that these are used correctly.

PROZON will assure the quality of the recycled refrigerant and oversee the price charged for the recycling process, which will have been previously agreed between PROZON and the enterprises participating in the programme.

6. ANALYSIS OF THE PROPOSED APPROACH

A variety of approaches have been considered concerning the implementation of the recovery and recycling Programme. The present project proposal has the following characteristics:

- Rapid overall implementation;
- A reduction in CFC imports of 182 ODP tonnes;
- Low cost for both up-front and continuing operations;
- Unrestricted geographic coverage;

- An opportunity to update technical knowledge and improve MAC servicing practices through the Training Seminars;
- Technicians will have the opportunity to reuse the CFC 12 that has been recovered and recycled;
- MAC system owners will be permitted to continue use to their MAC systems without having to bear the high cost of replacement, retrofitting to a non-CFC alternative refrigerant;
- A National Consultant, who will report to PROZON, will be responsible for monitoring the use of the equipment and the logbooks of the technicians. This should lead to a better understanding of the service sector and the programme's impact; and
- Since the Government maintains ownership of the units during the life of the programme, it is possible, if considered necessary, to redistribute the R&R equipment to locations that will make best use of them.

7. SPECIAL ARRANGEMENTS (AWARENESS)

Providing information and stimulating motivation are probably the least expensive and most effective way to reduce the amount of CFC 12 consumption in the MAC service sub-sector. Part of PROZON's mandate is to increase awareness on issues relating to Ozone layer protection.

8. INSTITUTIONAL ARRANGEMENT

PROZON will co-ordinate the implementation of this programme. Where possible, the Training Seminars will be conducted at National Training Institutions such as SENAI.

9. INPUTS

9.1 EQUIPMENT

The following criteria were used for the selection of the equipment:

450 MAC system servicing enterprises will receive a CFC 12 refrigerant recovery/recycling machine and necessary ancillary equipment.

Based on the above, the following equipment will be provided.

9.2 EQUIPMENT NEEDED FOR RECOVERY/RECYCLING OF CFC 12 REFRIGERANT FROM MAC

450, CFC 12 MAC recovery/recycling/evacuating/charging machines. The unit will be designed to recover, recycle and charge CFC 12 refrigerant directly from an automotive or mobile A/C systems (MAC), and will incorporate a vacuum pump and heated internal charging cylinder. The recovery, recycling and transfer of the CFC 12 to the internal charging cylinder will be performed in one single continued process (not multi-pass), must be fully automatic (i.e. no manual operation) and must be capable of recovering and recycling a minimum 4 Kg of CFC 12 without operator supervision.

450, CFC 12 MAC recovery equipment kits. Each kit will include: 1 oil charge kit, 1 electronic leak detector, 1 thermometer, service couplings, 1 valve core remover, 2 pairs of goggles and 2 pairs of gloves.

450, DOT refillable 50 lb. CFC 12 refrigerant cylinders with dual port and a compatible OFP switch.

Maintenance and spare parts for the above.

10. DISTRIBUTION AND SITING OF THE RECOVERY AND RECYCLING EQUIPMENT

10.1 DISTRIBUTION OF MAC RECOVERY/RECYCLING EQUIPMENT

Of the 450 MAC recovery/recycling machines, 450 MAC recovery/recycling equipment kits and 450 50lb. cylinders, 1 of each item will be made available, under the supervision of PROZON, to 450 MAC service enterprises.

10.2 SITING OF THE MAC RECOVERY/RECYCLING EQUIPMENT

The MAC recovery/recycling equipment will be sited in the enterprises MAC service facilities. The enterprise receiving the equipment will express its willingness to participate in the R&R programme, will agree to the conditions laid down by PROZON and will be responsible for its correct operation.

10.2.1 CONDITIONS FOR THE SITING OF THE RECOVERY/RECYCLING EQUIPMENT

Any suitable enterprise or entity servicing MAC systems within Brazil will have the right to submit an application to PROZON to participate in the R&R Programme along with a declaration of their historic CFC 12 consumption and their qualifications. PROZON will select the most appropriate sites for the R&R equipment.

The selected participants will be expected to possess a protected but properly ventilated area for the siting of the recovery/recycling equipment and for the storage of recycled refrigerant. They will also posses adequate MAC servicing equipment and facilities for the storage of refrigerant recovered but considered not recyclable within this programme (i.e. other types of refrigerant or contaminated CFC 12), until means are found for their recycling or destruction..

At least one senior technician/mechanic responsible for the operation of the recovery/recycling machine must attend one of the Project's Training Seminars and obtain the Programme's R&R Certification.

11. REDUCTION OF CFC 12 CONSUMPTION

The achievable annual reduction in CFC 12 consumption resulting from the successful implementation of this project is estimated as follows:

- 450 medium capacity MAC recovery/recycling machines would recover and recycle an average of 1.5 kg. of CFC 12 refrigerant per machine per day.
- There are 270 working days per year.
- Annual recovered CFC 12 would amount to 182 ODP tonnes.
- 100% of the recovered refrigerant can be recycled.

Therefore, the annual CFC 12 refrigerant recycled would amount to 182 ODP tons.

12. OPERATIONAL, QUALITY AND PRICING CONTROLS

12.1 OPERATIONAL CONTROL

PROZON will be the co-ordinating body. PROZON will have responsibility for overseeing and assuring a correct implementation and monitoring of the MAC recovery and recycling

programme. The duties of PROZON will include selecting the participants, preparing and conducting the Training Seminars, purchasing and distributing the MAC recovery/recycling machines and ancillary equipment, overseeing the monitoring of the equipment's correct usage and the amounts of CFC 12 recycled and, where necessary, repossessing and reallocating the R&R equipment.

12.2 QUALITY CONTROL

Under the supervision of PROZON, periodic samples will be taken of the recycled refrigerant and the samples will be analysed to assure correct degrees of cleanliness.

12.3 PRICING OF RECYCLED REFRIGERANT

The price charged by the participants for recovering and recycling CFC 12 refrigerant will not be more than that which will reasonable cover the operational costs of the recovery and recycling process, including man hours, analysing the refrigerant, replacement of recycling filters, energy, operating and storage space, maintenance and servicing. This price will be agreed upon under the supervision of PROZON.

13. EXPECTED PROGRAMME RESULTS.

The following are results expected from the R&R Programme.

- Training of technicians in the MAC service sub-sector that will result in reduced emissions of CFC 12 during the servicing of MAC systems.
- Recovery and recycling of CFC 12 refrigerant during MAC servicing.
- Recovery and recycling of CFC 12 refrigerant before CFC 12 MAC "retrofitting" or replacement, and the retirement of CFC 12 based MAC systems.
- Encouragement for vehicle repair shops, which commence MAC servicing after the initiation of the R&R Programme, to incorporate the recovery and recycling of refrigerants.
- Reduction of 182 ODP tons/year in CFC 12 consumption is expected.

14. TIMETABLE

TASK	TIME OF COMPLETION													
TRIMESTER	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Preparation														
Equipment Procurement	x	xxx	xxx											
Arrival of Equipment				x										
2. Training Seminars				xx										
3. Equipment Distribution				xx										
4. Recovery and Recycling				xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx
5. Monitoring System														
Setting up				xxx										
Monitoring				xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	
6. Project Completion Report														xxx

16. PROJECT COSTS

TRAINING SEMINARS.

	US$
One National R&R Expert & Lecturer	25,000.00
One National Consultant	5,000.00
One Administrative Assistant	2,500.00
Travel Expenses and DSA	20,000.00
15 Venues, Catering and Logistical Arrangements for the Seminars	9,750.00
Printing, Technical Material and Literature	2,400.00
Material for Participants and Practical Training	4,250.00
Equipment Transport	12,000.00
SUB-TOTAL	**80,900.00**

MAC RECOVERY AND RECYCLING EQUIPMENT

	US$
450, MAC Recovery/Recycling Machines	1,305,000.00
450, MAC Recovery/Recycling Equipment Kits	117,000.00
450, 50lb. Recovery Cylinders with Two Ports, with OFP	45,000.00
Maintenance and Spares	40,500.00
Freight Costs	112,500.00
Contingencies (10% of the above)	162,000.00
SUB-TOTAL	**1,782,000.00**

16.3 INCREMENTAL OPERATING COSTS

All operating costs will be covered by the charge levied as the sale-back price of the recycled refrigerant. The project will be monitored by PROZON to assure that the sale back price is balanced in such a manner that neither financial profit nor loss shall be incurred by the operators of the MAC recovery/recycling machines.

16.4 MONITORING COSTS

A National Consultant, working under the overall control of PROZON, will conduct the activities under this heading.

	US$
National Consultant (3 years)	90,000.00
Lap top Computer and Spread Sheet Soft Ware	2,500.00
Travel expenses and DSA (2 1/4 years)	12,500.00
Office Materials and Communication Expenses (3 years)	8,500.00
SUB-TOTAL	**113,500.00**

TOTAL INCREMENTAL COSTS

	US$
Training Seminars	80,900.00
MAC Recovery/Recycling Equipment	1,782,000.00
Project Monitoring	113,500.00
TOTAL PROJECT COSTS	1,976,400.00

TOTAL PROJECT COSTS	**US$ 1,976,400.00**

ANNEX 1

TECHNICAL REVIEW

NATIONAL PROGRAMME FOR RECOVERY & RECYCLING OF CFC 12 REFRIGERANT IN THE MOBILE AIR-CONDITIONING SERVICE SECTOR

ATTACHMENT 6.

CFC RECOVERY AND RECYCLING IN THE CENTRIFUGAL CHILLER SERVICE SECTOR

COUNTRY :		Brazil
SECTORS COVERED :		Refrigeration and Air Conditioning
ODS CONSUMPTION IN AFFECTED SECTOR :		28 ton of CFC 11 and 60 ton of CFC 12
PROJECT TITLE :		CFC Recovery and Recycling in the Centrifugal Chiller Service Sector
PROJECT DURATION		
PROJECT IMPACT		
PROPOSED BUDGET	Investment Costs	**US$ 1,163,670**
	Net Operational Costs	**-**
	Total Project Cost	**US$ 1,163,670**
IMPLEMENTING AGENCY :		
NATIONAL COORDINATING AGENCY :		

PROJECT SUMMARY

The principal objective of this project is to reduce the consumption of virgin CFCs in the service of centrifugal chillers employed in the air-conditioning and industrial refrigeration sectors. This project is to enable the recovery and recycling of CFC 11 and CFC 12 during service and repair of these centrifugal in order to prolong their useful working life and to avoid premature retirement. This action is essential because of enforced reductions in CFC consumption required before 2005, and the planned phase-out of CFC consumption in Brazil in 2007.

This project will provide two machines for CFC recovery and recycling, one for low-pressure refrigerant (CFC 11) and other for high-pressure (CFC 12), 15 maintenance and technical assistance companies engaged in the servicing of centrifugal chillers. 10 refrigeration mechanics from each of these 15 companies engaged in the servicing of centrifugal chillers will also be trained at ABRAVA. The training courses will prepare the refrigeration mechanics for the activities of CFC recovery, recycling, and storage.

The training will also emphasize the essential need for CFC recycling, and will include information on the relevant environment regulations that already prohibit the venting of CFC refrigerants to atmosphere.

A management structure will be established to supervise and monitor the project.

PROJECT OF THE GOVERNMENT OF BRAZIL

1. OBJECTIVES

The principal objective of this project is to reduce the consumption of virgin CFCs in the service of centrifugal chillers employed in the air-conditioning and industrial refrigeration sectors. This project is to enable the recovery and recycling of CFC 11 and CFC 12 during service and repair of these centrifugal in order to prolong their useful working life and to avoid premature retirement. This action is essential because of enforced reductions in CFC consumption required before 2005, and the planned phase-out of CFC consumption in Brazil in 2007. This project will provide two machines for CFC recovery and recycling, one for low-pressure refrigerant (CFC 11) and other for high-pressure (CFC 12), 15 maintenance and technical assistance companies engaged in the servicing of centrifugal chillers. 10 refrigeration mechanics from each of these 15 companies engaged in the servicing of centrifugal chillers will also be trained at ABRAVA. The training courses will prepare the refrigeration mechanics for the activities of CFC recovery, recycling, and storage. The training will also emphasise the essential need for CFC recycling, and will include information on the relevant environment regulations that already prohibit the venting of CFC refrigerants to atmosphere. A management structure will be established to supervise and monitor the project.

2. SECTOR BACKGROUND

Estimates based on surveys conducted for preparation of the National CFC Phase-out Project indicate that there are about 700 centrifugal chillers used in industrial process refrigeration and building air-conditioning. The survey also indicated that some 28 tons of CFC 11 and 60 tons of CFC 12 were consumed in the servicing of these chillers during 2000. This includes the “top-up” of refrigerant losses during equipment operation, as well as the venting of the refrigerant charge during service and repair activities. The use of CFCs for the cleaning of systems during repair, as well as the overcharging of refrigerant, may also contribute to this consumption..

ABRAVA estimates that 35% of the total inventory of centrifugal chillers is located in the State of São Paulo. In this way, 245 centrifugal chillers, representing around 80 installations of central air conditioning and industrial refrigeration, are located in São Paulo.

3. CURRENT TECHNOLOGY IN USE FOR SERVICING

During maintenance operations in a centrifugal chiller, performed once a year, the normal procedure used for recovery the CFC charge is:

Low-pressure chillers using CFC 11 as refrigerant

System is pressurized with nitrogen to transfer the refrigerant to the drums. The remainder of the refrigerant that it is not possible to remove through this procedure is removed by means of vacuum and vented to the atmosphere.

High-pressure chillers using CFC 12 as refrigerant

The refrigerant is transferred to the cylinders using transfer pumps and the remainder is removed from the system and vented to the atmosphere.

Basically, these losses are due to two main factors:

- Non-existence of refrigerant recovery, and recycling equipment and practices;
- Lack of training, proper tools, and a lack of awareness of environmental issues at the service technician level.
- Lack of awareness of environmental issues at the chiller owner level.

4. PROJECT DESCRIPTION

4.1 Methodology

The maintenance and repair companies develop similar activities concerned to the installation and servicing of chillers. The recovery and recycling technology is not part of the current maintenance procedures carried out by these companies. In this way, it was considered adequate to develop a standardized project that could satisfy their basic characteristics.

PROZON and UNDP will identify and select companies, technical assistance companies that will be able to receive equipment in order to implement CFC recovery and recycling in their maintenance and repairing activities. These companies will also have a training course for their mechanics.

The project will be implemented in the several regions of Brazil at the same time due to the specific characteristics of the companies and the small number of installations, when one compare to commercial refrigeration

As most of the companies performs maintenance operations in both low pressure and high pressure chillers, using CFC 11 and CFC 12 respectively, it is required the use of two types of recovery/recycling equipment one for each class of chiller.

Two machines for CFC recovery and recycling, one for low pressure refrigerant (CFC 11) and other for high pressure (CFC 12), will be acquired[5] and used in the maintenance of installations of building air conditioning/industrial refrigeration systems. Four tanks for CFC 11 storage, one for CFC 12 storage, and six leak detectors will also be purchased to be used in recovery and recycling operations.

These equipment items will be acquired based on the following criteria:

- Cost of the system ready for use;
- Performance (amount of refrigerant recovered, level of vacuum, etc.);
- Dimensions, weight and portability;
- Durability and transportability;
- Availability and cost of technical support (maintenance), components, and spare parts;
- Commercial availability in the domestic market.

During the repair and maintenance operations, storage tanks are needed for storing the refrigerant allowing its recovery, recycling and re-introduction into the system. The difference between the number of tanks for CFC 11 and CFC 12 is due to the greater number of installations using this refrigerant than CFC 12, and also to the prospect that recovery and

[5] In the case the company performs maintenance only in one type of chiller, it will receive one or two (depending of the number of activities) recovery & recycling equipment specific for the type of chiller served

recycling operations in future installations will be performed more in low-pressure chillers (CFC 11) than in high-pressure chillers (CFC 12).

4.2 Project Monitoring

PROZON and UNDP will monitor the equipment use. This activity will permit to collect important information, like the amount of refrigerant recovered and recycled by installation, region, etc. The data will be stored in a specific data bank. Samples of refrigerant recycled will be also sent periodically to the regional CFC recycle/reclaim centres for laboratory analysis and confirmation of quality. All these data will be used for project evaluation and it will help the adjustments.

4.3 Training Courses for Mechanics

The training courses will prepare the mechanics for the activities involved in the CFC recovery, recycling, recharge, and storage. They will be focused on the appropriate recovery and recycling, practices, standardization, regulation, inspection and certification.

The courses will be developed by ABRAVA that has already developed a similar course in 1998 in São Paulo SP. The courses will focus not only the technical subjects related to CFCs recovery , recycling and reclaiming but also on the negative impact of CFCs released in the atmosphere, and the benefits of this conservation program including life span of refrigeration and air conditioning equipment. The courses will be based on the training manual "Chillers and Refrigerant Management" elaborated by UNEP, and presented in annex 1. They will also use appropriate ASHRAE standards and technical procedures. The cost predicted for this training program involves the elaboration of a Portuguese version of the UNEP manual, and the costs related to instructors. Each company will have a quota of 10 participants in the courses.

5. POTENTIAL REDUCTION OF CFC EMISSION

Based on the case study reported by UNEP[6], normal CFC 11 recovery operation using nitrogen overpressure should not be used, and using specific recovery equipment, as intended in this project, it is possible to obtain a recovery efficiency of more than 99%. For CFC 12 the same conclusion can be used.

6. MANDATORY REGULATION

CONAMA Resolution No. 267 of 14 September 2000 requires that during each and every process of removal of controlled substances from the place of its installation or in repair and maintenance workshops, the refrigerants must be appropriately collected, packaged and later sent to incineration centres or recycling units licensed by the competent environmental agency. In the absence of incinerators or recycling centres licensed by the competent environmental agency, the substances must be appropriately packaged in containers that meet the standards NBR 12,790 and NBR 12,791, or later standards.

While this may be intended to achieve a reduction in the consumption of CFCs in the service sector it will not be effective unless the refrigeration mechanics and technicians in the service sector are appropriately trained and equipped. This legislation could be usefully

[6]United Nations Environment Programme. Refrigerant Recovery and Recycling - Case Studies. OzonAction Information Clearinghouse. Ozone Action Programme. July, 1994.

improved including a requirement for refrigeration mechanics and technicians to be "Certified" following training in CFC management, conservation, and replacement.

7. TIMEFRAME

The project's implementation schedule is presented in **Table 1**.

TABLE 1. PROJECT IMPLEMENTATION[7] SCHEDULE

	1st YEAR		2nd YEAR		3rd YEAR	
	1st Sem	2nd Sem	1st Sem	2nd Sem	1st Sem	2nd Sem
Contract with PROZON/UNDP	xxxx					
Procurement of Recovery & Recycling Machines	xxxxx					
Procurement of Storage Cylinders	xxxxx					
Procurement of Leak Detectors	xxxx					
Installation of Equipment		xxxxx				
Training Programme: **Didactic Material** **Mechanics Course**	xx	x xxxxx	xx			
Setting up Recovery & Recycling Operations			xxxxxx	xxxxxx		
Supervision and monitoring	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxx	xxxxxx
Project Management	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx

8. PROJECT COSTS

The project total cost is US$ 1,163,670, comprised only of investment costs.

Investment Costs	US$
Recovery/Recycling Equipment CFC 11 equipment (York* model RSR-2212) CFC 12 equipment (York model RSR-2250)	 12,463 27,501
Storage Tanks CFC 11(York model RT-1600) CFC 11(York model RT-2222)	4,585 x 4 = 18,340 7,094 x 1 = 7,094
Leak Detectors	400 x 6 = 2,400
Contingencies (10%)	6,780
Training Courses	300 x 10 = 3,000
Sub-total	**77,578**
TOTAL COST (15 companies x US$ 77,578)	**1,163,670**

** Based on quotations from York International Corporation*

[7] procurement, establishment, etc...

ANNEX 1 TRAINING COURSE

Chillers and Refrigerant Management

1 - Environmental Overview

Ozone Depletion
The Montreal Protocol
The Greenhouse Effect and Global Warming
National Requirements

2 - Overview of Refrigerants and Chillers

Overview of Refrigerants
Overview of Centrifugal Chillers

3 - Refrigerant Management Plan

The Importance of a Long Range Refrigerant Management Plan
Elements of A Refrigerant Management Plan
Policy and Procedure Statements
Refrigerant Containment Plan
Equipment Retrofit/Replacement Strategy

4 - Containment and Service Practices

Sources of Refrigerant Loss from Chillers
Equipment to Prevent Excess Refrigerant Loss
Types of Recovery/Recycling Equipment
Handling, Storage and Disposal of Refrigerants and Lubricants

5 - **Retrofit and Replacement**

Retrofit Options
Retrofit of CFC 11 chillers to use HCFC 123
Retrofit of CFC 12 chillers to use HFC 134a
Relative Total Cost for Each Retrofit
Replacement Options

ANNEX 1

TECHNICAL REVIEW

CFC RECOVERY AND RECYCLING IN THE CENTRIFUGAL CHILLER SERVICE SECTOR

ATTACHMENT 7.

INCENTIVE PROGRAMME FOR THE CENTRIFUGAL CHILLER END-USER SECTOR

COUNTRY :		Brazil
SECTORS COVERED:		Centrifugal Chiller End-User Sector
ODS CONSUMPTION IN AFFECTED SECTOR		28 tons of CFC 11 & 60 tons of CFC 12
PROJECT TITLE :		INCENTIVE PROGRAMME FOR THE CENTRIFUGAL CHILLER END-USER SECTOR
PROJECT DURATION		5 years
PROPOSED BUDGET	Investment Costs	**US$ 6,146,000**
	Net Operational Costs	-
	Total Project Cost	**US$ 6,146,000**

IMPLEMENTING AGENCY :
NATIONAL COORDINATING AGENCY :

PROJECT SUMMARY

The objective of this project is to eliminate as much as possible of the CFC 11 and CFC 12 consumption in the centrifugal chiller service sector by providing an incentive to chiller owners to encourage them to replace their existing CFC based chillers with new chillers based on zero-ODP, or low-ODP, refrigerants, or to permanently retrofit their existing CFC based chillers to use zero-ODP, or low-ODP, refrigerants.

The Incentive is in the form of an Incentive Payment based on CFC consumption when equipment is replaced, or the cost of permanent retrofit & CFC consumption when equipment is retrofitted. The incentive payments will range from US$ 6,000 - US$ 18,000.

The "Incentive Programme" will be publicized via ABRAVA, and the local representatives of the chiller manufacturers. Applications for the incentive payments/loans will be sent to PROZON during the period 2003 - 2007.

PROZON will oversee this programme together with Agency assistance as required.

Note: This National CFC Phase-out Plan does not address the total resource needs for CFC Chiller replacement.

PROJECT OF THE GOVERNMENT OF BRAZIL

1. PROJECT OBJECTIVE & ELIGIBILITY

The objective of the Incentive Programme Project is to eliminate as much as possible of the consumption of CFC 11 and CFC 12 in the centrifugal chiller service sector through the payment of a financial incentive to chiller owners that have existing operating chillers that use CFC 11 or CFC 12 refrigerant to encourage them to replace their existing chillers with new chillers based on zero-ODP, or low-ODP, refrigerants, or to permanently retrofit their existing chillers to use zero-ODP, or low-ODP, refrigerants. Chiller owners will be eligible to apply for an Incentive Payment if:

- They ***REPLACE*** the existing CFC based centrifugal chiller with a new chiller that uses a refrigerant that is not an Ozone Depleting Substance (e.g. R134a), or that uses a refrigerant that has only a small potential to deplete the Ozone Layer (e.g. HCFC 123, or HCFC 22.).

or

- They ***PERMANENTLY RETROFIT*** the existing refrigeration equipment to use a refrigerant that is not an Ozone Depleting Substance (e.g. R134a), or that uses a refrigerant that has only a small potential to deplete the Ozone Layer (e.g. HCFC 123, or HCFC 22.).

The duration of this programme is extended throughout 2007. Any enterprise that wishes to come forward with a request for an incentive payment can do so whenever they decide to replace, or retrofit, their CFC based chiller, and can do so between 2003 and 2007. However, as the incentive programme will be operated on a first come, first served basis, it is expected that it will lead to early reductions in CFC consumption.

2. SECTOR BACKGROUND

Estimates based on surveys conducted for preparation of the National CFC Phase-out Project indicate that there are about 700 CFC based centrifugal chillers used in industrial process refrigeration and building air-conditioning. It is recognised that there may be a small number of chillers, especially older ones that have not been caught by the survey. The survey also indicated that some 28 tons of CFC 11 and 60 tons of CFC 12 were consumed in the servicing of these chillers during 2000. This includes the "top-up" of refrigerant losses during equipment operation, as well as the venting of all, or part, of the refrigerant charge during service and repair activities. The use of CFCs for the cleaning of systems during repair, as well as the overcharging of refrigerant, may also contribute to this consumption.

CFC chillers continued to be installed up until 1993. The majority of the existing chillers were installed in the late1980s and early 1990s. While there has been replacement of older CFC chillers with non-CFC chillers during the past 8 years, this was because of the age of the chillers rather than for environmental reasons. Very few CFC chillers have been retrofitted to use non-CFC refrigerants. As the average lifetime of a chiller in Brazil is around 25 years, a substantial number of CFC chillers installed between 1982 and 1993 will still have remaining anticipated working lifetimes of between 1 to 11 years when CFCs are phased-out in Brazil in 2007.

Some CFC 11 chiller owners face chiller replacement because retrofit of their chillers to use HCFC 123 is technically difficult and it is not a cost-effective option. It may also not be cost-effective to retrofit older CFC 12 chillers. Chiller replacement is very costly (circa US$

135,000 for a 500 TR capacity chiller), and even for retrofit of those chillers that from a technical standpoint can be easily retrofitted from CFC 11 to HCFC 123, or from CFC 12 to HFC 134a, the costs involved are far from insignificant (US$ 25,000 – US$ 32,000 to retrofit a 500 TR CFC 11 chiller to use HCFC 123).

In order to reduce the economic impact of CFC phase-out, it is therefore important to take all possible measures to prolong the lifetime of the existing chillers and the strategy for that is based on the recovery and recycling of CFCs during service and repair operations. As replacement or retrofit must also be addressed, the additional elements of the strategy for the chiller sector are:

- An "Incentive Programme" for chiller replacement or retrofit to use non-CFC refrigerant based on proven high levels of CFC consumption and confirmed technical feasibility of System Retrofit.

To implement this proposal a further survey of the sector is required to establish a detailed inventory of installed chillers by capacity, refrigerant type, age, and application, as well as the identities of the chiller owners. With this information the chiller owners can be made directly aware of the legislation that will phase-out all Annex A CFCs in 2007, and the need to take early action to reduce, and if possible eliminate, their dependence on CFC refrigerants. It will also provide the opportunity for direct discussion on the incentive payment part of the strategy for phasing-out CFC consumption in the chiller sector, and enable the most secure and cost-effective options to be selected.

3. GENERAL JUSTIFICATION FOR A REFRIGERATION END-USER PROJECT

While there are no Decisions or guidelines specifically relating to the central air-conditioning or industrial refrigeration end-user sectors, Decision 28/44 relating to the commercial refrigeration end-user sector might be considered as applicable also to these sectors. The conditions to be met and Brazil's compliance with these conditions could then be summarised as follows:

5) That the country has production and import controls on CFCs and CFC based equipment in place and effectively enforced, and restricts the deployment of new CFC components; - ***Brazil has CONAMA Resolution No. 267 of 14 September 2000 that covers these requirements.***

6) That at the time of seeking compensation in the form of grants for end-user conversions, the country can establish that its major remaining consumption is for the servicing of refrigeration and air-conditioning equipment; - ***The total consumption of 4,938 ODP tons of CFC 11 and CFC 12 in the refrigeration service sector represents 86% of the remaining CFC 11 and CFC 12 eligible for funding under Decision 35/57.***

7) To establish the above, a comprehensive data on the profile of all remaining consumption has been determined and made available to the Executive Committee; - ***A breakdown of CFC consumption is presented within the Brazil National CFC Phase-out Project proposal.***

8) That either no other possible activities would allow the country to meet its CFC control obligations, or the comparative consumer price of CFCs, relative to substitute refrigerants, has been high for at least 9 months and is predicted to continue to increase. ***- This project proposal forms part of the strategy to eliminate CFC 11 and CFC 12 consumption in the centrifugal chiller service sector as proposed in the Brazil***

National CFC Phase-out Project proposal. The price of CFCs has almost doubled in the past 6 months.

4. TECHNOLOGY OVERVIEW

The following two options to eliminate CFC consumption are potentially available to some end-users in the centrifugal chiller sector, although for owners of older CFC 11 chillers the retrofit option may not be a technically feasible or cost-effective option:

1. Replacement of an existing CFC based chiller with a chiller designed to use a zero-ODP, or low-ODP refrigerant. This option requires a major investment. New chillers based on a zero-ODP refrigerant such as HFC 134a are commercially available and can be considered as a "once off" permanent replacement with no further change in refrigerant necessary based on a 25 years lifetime of the chiller. New chillers based on low-ODP HCFC refrigerants such as HCFC 123 or HCFC-22 are also commercially available. Whilst these may currently be environmentally acceptable solutions, they should be regarded as an interim solution that will require a further change to a zero-ODP refrigerant at some future date, although probably not within 25 years.

2. Retrofit of an existing CFC based chiller to use a zero-ODP refrigerant. This option that will prolong the useful lifetime of the existing chiller is technically feasible for some, but not all, existing chillers. The age of the equipment, and the economics of retrofit versus replacement must be considered. The retrofit option should only be selected if the evaluation of the initial cost and operational costs over the anticipated remaining lifetime of the equipment is substantially lower than the initial and operating costs of a new installation. For newer equipment, the initial cost of the retrofit option should be quite low as such equipment is usually designed for use with either CFC or HFC refrigerants and the procedure is thus simplified. Retrofit from a CFC refrigerant to a zero-ODP refrigerant such as HFC-134a may be regarded as a "once off" permanent solution with no further conversion of refrigerant necessary during the lifetime of the equipment. Retrofit of older CFC 11 chillers to use HCFC 123 may not be technically feasible or cost effective, and replacement would be a better option.

In conclusion and under the circumstances facing end-users in the centrifugal chiller sector in Brazil over the next 5 years, both the chiller replacement option, and the permanent retrofit option to convert a CFC based chiller to use a zero-ODP, or low-ODP, refrigerant will be a technically, environmentally, and sound financial proposition at a number of end-user enterprises.

5. PROJECT DESCRIPTION

Under this project any chiller owner that decides to replace, or retrofit, an existing CFC based chiller can apply to receive an incentive payment towards the cost of the replacement chiller, or retrofit of the existing chiller.

The two components of the project are:
- Information dissemination and monitoring activities.
- Incentive programme.

The first component focuses on informing the end-users in Brazil about the existence of the incentive programme and follow up on applications for incentives received from them. Activities will include:

- Printing of information leaflets about the programme to be distributed to chiller owners by mail and by other means using ABRAVA, and the local agents of the chiller manufacturers, etc.
- Review and evaluation of the applications for Incentive Payments received from end-users
- Annual reviews of the progress of the programme

The second component consists of the incentive payments to be provided to end-users. The conditions whereby end-users may receive an incentive payment, and the calculation of the amount of the incentive payment are given in the following section of the document.

6. CONDITIONS TO BE MET TO RECEIVE AN INCENTIVE PAYMENT.

1. Sector. The enterprise must belong to the chiller end-user sub-sector where the chillers are used for central air-conditioning and industrial refrigeration.

2. ODS and Alternatives. The eligible Ozone Depleting Substances (ODS) to be eliminated under this programme are CFC 11 and CFC 12. Centrifugal chiller end-users that will be considered under this incentive payment project will therefore have to replace their existing CFC 11 or CFC 12 based chiller with a non-CFC refrigerant-based chiller, or retrofit the existing CFC based chiller to use a zero-ODP, or low-ODP, refrigerant. Chiller owners will have a choice regarding which alternative non-CFC refrigerant-based technology they choose but the choice is limited to zero-ODP systems, or systems using simple HCFCs.

3. Duration and Modality. The programme may run during a period of five years (2003-2007). This duration could be shorter if the total funding of the incentive programme is exhausted before 2007. Applications for an incentive payment must be addressed to PROZON and they will be evaluated on a first-come first-served basis. A National Consultant will technically evaluate the applications. Any chiller owner can only apply once during the five-year period, even if they have several chillers. However, an owner can combine several of their chillers in the request for an incentive payment.

4. Eligibility. Chiller owners will only be eligible to receive an incentive payment if the owner had chillers that were in operation before 25 July 1995 (Ref, Decision 17/7 of the Executive Committee of the Multilateral Fund.). Proof of this must be attached to the application, together a letter certifying that the refrigeration equipment was in operation during the last 3 years.

An end-user wishing to apply for an incentive payment will have to include the following information in its application for an incentive payment:

- Details of the proposed conversion, which must be based on proven and mature technology.
- Details of the costs of the proposed chiller replacement, or retrofit.
- Details of the costs of the current CFC refrigerant, and the proposed replacement refrigerant.
- Confirmation that it can meet established local and international safety, health, and environmental standards related to the new refrigerant.

(Note: Where an existing chiller is to be replaced, the new chiller supplier will be expected to provide full technical support, and to provide all the required information on issues relating to safety, health, and the environment, during normal operation and emergency situations. Similar information in the form of Material Safety Data Sheets will be expected to be provided by the refrigerant supplier for conversions involving both equipment replacement, and retrofit.)

5. CFC Consumption. Applications must also contain information that establishes the average of the annual CFC (CFC 11 or CFC 12) consumption "C" over the last 3 years, and invoices confirming this CFC consumption must be attached to the application. The ODP of both CFC 11 and CFC 12 is 1.0. The yearly consumption data of the refrigerant in kilograms must be presented by the enterprise making the application using the following example format, and clearly indicating the refrigerant involved (CFC 11 or CFC 12):

(CFC 11 or CFC 12) REFRIGERANT CONSUMPTION DURING LAST 3 YEARS				
Year	(a) Opening Stock 01 January in Kilograms	(b) Purchases during the Year in Kilograms	(c) Closing Stock 31 December in Kilograms	(a) + (b) – (c) Annual Consumption in Kilograms
(2000)				
(2001)				
(2002)				
TOTAL CONSUMPTION LAST 3 YEARS				
AVERAGE CONSUMPTION LAST 3 YEARS (TOTAL CONSUMPTION/3)				

6. Baseline Equipment. Applications must contain sufficient information describing the current chiller at the end-user enterprise. This description should include as much as information as possible concerning the nature of the chiller, model, brand, year that the chiller was installed, as well as the price at purchase, serial number, capacity, CFC-charge, etc. Copies of the purchase order and invoice should be attached to the application, if available.

7. Recovery & Recycling of the CFC 11 & CFC 12 Refrigerant Charges in the Baseline Chillers. The CFC 11 and CFC 12 refrigerant charge in the existing chillers that are to be replaced, or retrofitted, must be recovered, and recycled. This will be co-coordinated with PROZON.

8. Conditions and determining the Grant "G" for an "Incentive Payment".
The grant "G" that will be paid to the applicant depends on the consumption "C" as determined in 5. above. It will be derived from the following table:

Average Annual Consumption "C" for Service & Repair of the Replaced, or Retrofitted, Equipment in ODP Kg	PRO-RATED Scale of Eligible Incentive Payment In US$

50 - 100	6,000
100 - 200	6,000 - 12,000
200 - 300	12,000 – 18,000
>300	18,000

Following completion of the conversion, invoices must be produced by the chiller owner to confirm the total costs incurred during the conversion process involving either chiller replacement, or retrofit. These invoices will relate to the purchase of capital cost items, to local works carried out by the enterprise, the cost of the initial charge of the replacement compressor lube oil, and to the cost of the initial new charge of the replacement refrigerant and any refrigerant consumption for leak testing.

The complete cost data submitted by the chiller owner to PROZON will be reviewed by the National Consultant who shall ensure that all of the required information has been provided. The National Consultant, shall then make a formal recommendation on the eligible level of the incentive payment to PROZON.

To receive the full incentive payment, a chiller owner must be able to demonstrate total costs for the conversion that exceed the incentive payment as calculated based on the CFC consumption and as described above. In the case that the total costs for the conversion are less than the incentive payment as calculated based on the CFC consumption, then the incentive payment to the enterprise will be limited to the verified eligible costs incurred in the conversion.

It should also be noted that the amount "G" is based on 100% Article-5 Country ownership. Funds for part Article-5 Country ownership will be reduced according to the percentage of Article-5 Country ownership of the enterprise.

9. Payment Modality and Destruction of Equipment.
After receipt of the required supporting documentation and approval of the application, up to 40% of the eligible incentive payment can be paid up front to the enterprise.

The eligible balance will only be paid after the existing CFC based chiller has been replaced, or permanently retrofitted, the total cost data has been reviewed and the National Consultant has made a formal recommendation on the actual level of the incentive payment, and formal certification that the existing CFC based chiller that was replaced has been destroyed/dismantled/rendered unusable with CFCs according to MLF policy decisions and guidelines.

Upon payment of the incentive, the enterprise will sign a statement confirming that it will no longer use CFC refrigerants in the chiller(s) covered by the project

10. Post Project Monitoring.
PROZON may sporadically conduct post-monitoring visits to end-users that have received an incentive payment, to ensure that the end-user does not return to the use of CFC refrigerants.

7. PROJECT COSTS

PROJECT BUDGET	US$
National Consultant to provide overall guidance, prepare materials to publicise project, evaluate applications for incentive payments, follow up on these with the end-users, final inspections of completed works, certification of completion and destruction of replaced chillers, final review of documents and recommendations relating to the level of incentive payment, monitoring activities, etc. (4 years)	100,000
Local Travel within the country	40,000
Publicity materials and activities, documentation for applications, newspaper ads, etc.	6,000
Funding for "Incentive Payments" to the Chiller Owners	6,000,000
TOTAL COST	**6,146,000**

8. PROJECT IMPLEMENTATION AND MONITORING

Year	2003				2004				2005				2006				2007			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Contract Consultant	X																			
Publicity		X	X																	
Incentive Programme Running		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Project Review				X				X				X				X				X
Project completed																				*

**** The project can run beyond 2007 for "Incentive Payments" if there are remaining funds, and if there remain chiller owners that are eligible for assistance but have yet to replace, or retrofit, their CFC based chillers. This extension of the project will be managed by PROZON based on experience gained pre-2007.***

ANNEX 1

TECHNICAL REVIEW

INCENTIVE PROGRAMME FOR THE CENTRIFUGAL CHILLER END-USER SECTOR

ATTACHMENT 8.

TRAINING OF CUSTOMS OFFICERS IN BRAZIL

COUNTRY:	Brazil
PROJECT TITLE:	Project for training of customs officers in Brazil
PROJECT IN CURRENT BUSINESS PLAN:	Yes (GTZ)
SECTOR:	National CFC Phase-out Plan
CFC USE IN COUNTRY:	9,276 ODP tons (2000 consumption)
PROJECT DURATION:	24 months
PROJECT COSTS:	
REQUESTED GRANT:	**US$ 225,200**
IMPLEMENTING AGENCY SUPPORT COST	**US$ 29,276**
TOTAL COST TO THE MULTILATERAL FUND	**US$ 254,476 to be set off against German bilateral contribution to the MLF**
PROJECT MONITORING MILESTONES INCLUDED	Yes
COORDINATING AGENCY OF THE NATIONAL CFC PHASE OUT	UNDP
NATIONAL COORDINATING AGENCY	PROZON
IMPLEMENTING AGENCY FOR THIS PROJECT:	Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Germany

PROJECT OF THE GOVERNMENT OF BRAZIL

BACKGROUND

Brazil is now in the CFC consumption compliance phase of the Montreal Protocol and it must meet specific defined maximum annual levels of CFC consumption. In addition to its obligations under the Montreal Protocol to progressively reduce CFC consumption, it must also phase-out CFC consumption by 01 January 2010. However, the Brazilian Government had decided to accelerate the phase-out of CFC consumption by some three years to 01 January 2007.

Since Brazil stopped local production of CFCs in 1999, imports are now the sole source of CFCs. In addition to the local manufacture of CFC based products and equipment, Brazil also imports products and equipment that do, or could, contain CFCs. This equipment can be new and second hand. The monitoring and control of the import of bulk CFCs, mixtures of CFCs with other chemical substances, and products and equipment containing, or designed to contain or use CFCs, is then crucial to Brazil achieving its compliance targets on CFC consumption under the Montreal Protocol, and CFC phase-out on 01 January 2007.

OBJECTIVE

Customs officers will be trained in proper checking, recognition, testing and monitoring of imports of CFCs. The training of customs officers follows closely the implementation of the regulation concerning CFCs consumption in the country. The statistical registration systems in Brazil need to be modernized in order to effectively identify CFCs in the specific categories like virgin CFCs, mixtures of CFCs with other chemical substances, CFC containing systems etc.

EXPECTED RESULTS AND CRITERIA FOR SUCCESS

A total of 60 customs officers trainers from 24 states and 49 port and airport authorities will be trained in proper identification of CFCs and CFC containing products and systems. Only imports with a valid permit might cross the border. The Customs officers will be able to identify, by using the identification kits provided, whether the imports are CFCs or not. The co-operation between the CFC officer and customs officers will identify other potential code numbers under which CFCs might be imported. Together with the National Ozone Unit a workable statistical registration will be set up to effectively monitor and control imports of CFCs and to monitor whether the imports are diminished according to the country's obligations under the Montreal Protocol, and Brazilian legislation.

APPROACH

The 2-day training of customs officer is proposed (at least 2 such workshops would be held throughout the country) and will consist of the following elements:

- Understanding the need to control ozone depleting substances (CFCs),
- Workshop to identify CFCs and using of Customs Codes,
- Control import permits after any new CFC related legislation has been put in place,
- Draft a workable statistical registration system to monitor CFC imports

The National Ozone Unit (PROZON) together with the Customs Department will select the customs officers trainers who will attend the workshop. The training will consist of (but not be limited to) the following:

- Reasons for the import/export licensing requirements
- The approved regulations
- Procedure for application and approval of import licences
- Chemicals covered
- Common applications and appearance of the chemicals as they are traded
- Likely applicable customs code
- Procedure to be followed on arrival of CFC shipment
- Procedure for recording imported quantities
- Procedures and equipment needed to test for CFC content
- Applicable actions in case of no licence or suspicions on false or misleading declarations
- Export/import licensing requirements
- Statistical registration of imports found
- Regional cooperation (Mercosur countries)
- Contact person at NOU

TIME FRAME

A tentative time frame for the workshop for customs officers trainers is as follows:

ACTIVITY						
Quarter	1	2	3	4	5	6
Customs Officer Training						
Develop materials	XXX	XXX	X			
Contact and identify trainers	XXX	XXX	X			
Preparation of workshops			XXX			
Registration and data update			XXX	XXX		
Conduct customs officers trainer Workshop					XXX	XXX
Follow Up officer training implementation						XXX
Completion						X

CO-OPERATING PARTNERS AND THEIR ROLE

UNDP is the implementing agency for the National CFC Phase-Out Programme. The National Ozone Unit will be the responsible Government body for the implementation. GTZ will assist in the implementation of this customs officer training project.

SUPPORTING AND FOLLOW UP ACTIONS

To ensure enforcement of the CFC legislation; the Government will arrange inspections on demand. A meeting with representatives from the Bureau of Standards will be organised. Illegal import can be prevented through an increased information flow between the bordering countries.

MATERIALS/EQUIPMENT FOR EACH TRAINER

Training manual for Customs Officers.
Sets of original labels and leaflets for the ODS in trade within the sub region
Samples of empty containers.
1 set of videos.
1 set of slides.
1 set of training handouts (Transparencies and PowerPoint driven presentations).

Desk books.
ODS-Customs posters.
ODS Identification kit.

TOTAL COST ODS CUSTOMS TRAINING BRAZIL

Item	Single Unit Price	Units/time		Times	**Total US$**
INTERNATIONAL CONSULTANT					
Customs Training Consultant	$450	5	days/workshop	2	4,500
Registration system Update	$450	3	days	1	1,350
Preparatory/Follow Up Training officers	$450	5	days	1	2,250
DSA-consultants	$350	14	days	1	4,900
International Flights Consultant	$7.000	1	mission	1	7,000
Sub-total					***20,000***
TRAINERS					
Trainer daily allowance	$100	4	days/workshop	60	24,000
Local Transport	$300	1	workshop	60	18,000
Accommodation	$60	2	days/workshop	60	7,200
Sub-total					***49,200***
WORKSHOPS					
Training Material	$450	1	set/workshop	60	27,000
Workshop expenditures/consumables (rent, refreshments)	$5.000	1	days/workshop	2	10,000
Identification kits	$1.500	1	trainer	60	90,000
Calibration of testing equipment at an existing laboratory					10,000
National Expert/Coordinator	$250	40	days	1	10,000
Sub-total					***147,000***
Component Total					***216,200***
CONTINGENCY					***9,000***
REQUESTED GRANT					***225,200***
Support Cost					***29,276***
Total Cost					***254,476***

Training Materials	Cost US$
Training manuals/literature for Customs Officer Training	40.00
1 set of original labels and leaflets for the ODS in trade	10.00
Samples of empty containers	50.00
1 set of videos	50.00
1 set of slides	50.00
1 set of training handouts (Transparencies and power point driven presentations)	30.00
Desk books	70.00
ODS-Customs posters	150.00
TOTAL	**$450.00**

U N D P - Project Proposal Review

Country: **BRAZIL**
Firm: **Various**
Type: **National Phase-out Plan**
Date: **April 2002**

RTU-UN/Pav-LK-20192-dl

Scope

The plan under review describes the consumption data and the measures to come to a national phase-out of CFCs in Brazil. Only parts related to refrigeration have been analysed. The different parts reviewed are described below in the sequence they are described in the NPP and this can be considered a first review. This is due to the fact that the review had to be done within a tight timeframe of about one day; if needed certain elements can be further analysed in the near future.

The overall impression of the National Phase-out Plan (NPP) for Brazil is that it is an adequate description of the consumption in the different sectors, of the replacement strategies and of the institutional framework behind the measures to be taken. Whether one should phase out by 2007, and what the implication is for the funds to be disbursed is an issue that is not for the reviewer, but this should be dealt with in the decision making process.

1. Objective

No comments regarding this description.

2. The Montreal Protocol

The figures presented do not raise comments, the consumption and compliance is described in an adequate manner, the demand for CFCs is correctly described. Table 1.2 and 1.3 are correct descriptions. It is important to describe the import licenses by IBAMA and the CONAMA resolution. The summary table on page 9 does not ask for comments; figures in table 1.5 seem to be in order. It is clear that the largest part (85%) of the remaining consumption is in the servicing sector. The last part of chapter 2 is a good description of the framework.

3. Project Summary

No comments

5. NPP

5.1, 5.2 and 5.3 do not require further comments.

Domestic Refrigeration sector description

Figures look reasonable (servicing at 900 ODP tonnes is high and could be reduced in future); the analysis that less than 10% is used by authorised workshops underlines this. The analysis of a possible overconsumption is correct. The phase-out strategy is in principle OK, the only question is whether one reaches the informal sector. This can only be addressed together with a national policy to make refrigerant available (whether new or recycled)

Commercial Refrigeration sector description

Figures look reasonable (servicing at 3300 ODP tonnes is high and should be reduced in future); the analysis that this is due to technician training and to badly maintained equipment. The analysis of a what will happen in future after 2007 is correct. The phase-out strategy is in principle OK, the only question is whether one should not involve more the early retirement of systems (which will also have become more energy efficient). This described under "incentive payment system fore equipment replacement".

MAC sector description

Figures look reasonable. In fact, the MAC sector is a relatively small sector in the total. It should be targeted that CFC-12 MACs are out of operation before the year 2010, rather than by 2015.

The earlier the CFC market is shut down the better. The year 2015 is acceptable if it is combined with government regulations, also where it concerns pricing of recycled refrigerant and limited availability. The Phase-out strategy proposed

contains all possible measures, under the assumption that HFC-134a is not likely to enter a significant part of the market, and that CFC-12 will remain attractive.

Chiller sector description
Figures for servicing look reasonable if it concerns chillers installed before 1993; however, this still refers to more than 500-600 chillers. This leads to the conclusion that servicing needs are too high (what is done with the charge when repairs are made etc., as mentioned in the proposal?). One mentions that chillers should be kept in operation as long as possible, however, it would be good if a chiller replacement strategy for the country would be designed in the near future under the NPP, so that old chillers are replaced by new ones, with energy efficiencies that are 30-40% higher. The electricity structure in the country would benefit from this. The phase-out strategy is in principle OK, it also contains the Incentive Payment Programme for Replacement, however, this could possibly be made more structured or financial incentives could be given to building owners to stimulate.

6. Action Plan (Refrigeration)

Domestic Refrigeration and Commercial refrigeration
The analysis that certain companies are still using CFCs in the manufacturing process may be very true. However, this figure needs be consistent with the 335 tons given for manufacturing in the earlier part of the proposal. Although the list is a summary of the investments, it could be OK, if more information on specific items and on the cost effectiveness is given in an Annex. The regulatory component given does not ask for comments.
The description of the servicing sector is in order. It is consistent with observations given earlier. The training project is a huge one. It must be assumed that one can oversee the quality of the 2500 training courses mentioned, where it is mentioned that this is given in an Attachment.
The part of the proposal describing recovery machines in combination with recycling and reclaim does not ask for comments. It should however, be emphasised that recovery on site should be applied as much as possible. The infrastructure and the necessary stimulus to bring refrigerants to recycling and reclaim centres may be disappointing.
The cost effectiveness or the costs required for the Incentive Programme cannot be judged.

MAC Servicing
It is correct that the reverse retrofit of HFC-134a systems is underlined, but this is very much related to the availability and cost of CFC-12. It is agreeable that training and recover and recycle in the workshops are the most important elements. The Incentive Programme is agreeable, but the level of the costs necessary cannot be judged.

Chillers
The analysis of the servicing is correct. It is agreeable that an Incentive Programme is proposed. It is very much supported that a survey will be undertaken and that further strategies are designed to stimulate earlier replacements (maybe in some cases also retrofits) which also will have a positive impact on the country's electricity consumption.
The issues described under CFC R&R and under the Incentive Programme are in principle supported.

The issues under capacity building, project implementation and monitoring are considered to be in order.

The NPP for Brazil, as reviewed in a shorter form (without extra information and without attachments), **is supported** where it concerns the strategies, and the technical approaches **in the refrigeration sector only**.

Eindhoven, 02 04 23
Kuijpers, LJM