



**Programa de las
Naciones Unidas
Para el Medio Ambiente**



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COMITÉ EJECUTIVO DEL FONDO MULTILATERAL
PARA LA APLICACIÓN DEL
PROTOCOLO DE MONTREAL

Trigésima cuarta Reunión
Montreal, 18 al 20 de julio 2001

PROPUESTA DE PROYECTO: TURQUÍA

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

Refrigeración:

- Plan sectorial de eliminación de SAO en refrigeración Banco Mundial

HOJA DE EVALUACIÓN DE PROYECTOS TURQUÍA

SECTOR: Refrigeración Uso de SAO en el sector (1999): 741 toneladas PAO

Título del proyecto:

- a) Plan sectorial de eliminación de SAO en refrigeración

Datos del proyecto	Múltiples subsectores
	Plan sectorial
Consumo del sector en 1998 (toneladas PAO)	1 934*
Impacto del proyecto (toneladas PAO)	1 934
Duración del proyecto (meses)	48
Monto inicial solicitado (\$EUA)	5 000 000
Costo final del proyecto (\$EUA):	
Costo adicional de capital (a)	12 642 000
Costo de imprevistos (b)	
Costo adicional de explotación (c)	9 259 000
Costo total del proyecto (a+b+c)	21 901 000
Propiedad local (%)	100%
Componente de exportación (%)	0%
Monto solicitado(\$EUA)	
Costo eficacia (\$EUA/kg.)	9,50
¿Financiación de contraparte confirmada?	
Organismo nacional de coordinación	Fundación de Desarrollo de Tecnología de Turquía
Organismo de ejecución	BIRF

Recomendaciones de la Secretaría:	
Monto recomendado (\$EUA)	
Impacto del proyecto (toneladas PAO)	
Costo-eficacia (\$EUA/kg)	
Costos de apoyo del organismo de ejecución (\$EUA)	
Costo total al Fondo Multilateral (\$EUA)	

*Como se indica en el plan sectorial.

DESCRIPCIÓN DEL PROYECTO

Antecedentes

- Información disponible más reciente sobre el total de consumo de SAO (1999)	2 439,0 toneladas PAO
- Consumo básico de sustancias del grupo 1, anexo A (CFC)	3 805,70 toneladas PAO
- Consumo de sustancias del grupo 1, anexo A para el año 1999	1 791,10 toneladas PAO
- Consumo básico de CFC en el sector de refrigeración	No disponible
- Consumo de CFC en el sector de refrigeración en 1999	741,40 toneladas PAO
- Fondos aprobados para los proyectos de inversión en el sector de refrigeración a fines de 2000	\$EUA 9 384 153,00
- Cantidad de CFC a eliminar en proyectos de inversión en el sector de refrigeración al final de 2000	1 200,00 toneladas PAO

1. Se informó a la Secretaría que los datos de consumo de CFC en el sector de refrigeración en Turquía de 1998 indicaban 1.796 toneladas PAO de CFC-12 y CFC-115 y 741,4 toneladas PAO en 1999. No se informó consumo de CFC-11 en el sector de refrigeración para 1998 y 1999.

2. El sector de refrigeración de Turquía comprende cuatro fabricantes de electrodomésticos de refrigeración doméstica, seis productores principales de equipos de refrigeración comercial generalmente unitarios y alrededor de 300 PyMEs que fabrican una variedad de equipos de refrigeración comercial unitarios y no unitarios. Dos de las principales compañías de refrigeración (Arcelik y Profilo) también participan en la fabricación de compresores herméticos. Además, hay alrededor de 2.500 pequeños talleres que ofrecen reparaciones y servicio para todo tipo de equipos de refrigeración. El Comité Ejecutivo aprobó 8 proyectos de inversión destinados a la conversión de la producción de productos de refrigeración comercial y no comercial y compresores herméticos a tecnologías que no usan SAO. También se aprobó un proyecto de demostración como actividad bilateral entre los EE.UU. y Turquía en el sector de servicio de MAC. El financiamiento total aprobado asciende a alrededor de \$EUA 9,4 millones para eliminar 1.200 toneladas PAO. Se terminaron los nueve proyectos de inversión.

Plan sectorial de refrigeración

3. El Plan sectorial de refrigeración para Turquía (TRSP) prevé el cese del consumo de SAO y la importación de equipos que contienen SAO para todas las aplicaciones de la industria

del sector de refrigeración, incluido el servicio, para 2005. La asignación total de \$EUA 21.901.000 se basa sobre los costos de los siguientes componentes individuales:

Componentes		Costo \$EUA
1.	Eliminación de SAO en los fabricantes de refrigeración pequeños y medianos	5 325 000
2.	Establecimiento de esquema de recuperación/reciclaje/reclamo;	5 085 000
3.	Capacitación de técnicos de servicio de refrigeración;	600 000
4.	Capacitación aduanera y provisión de equipos para el control eficaz de las fronteras	300 000
5.	Sensibilización, ejecución y supervisión	400 000
6.	Costo adicional de explotación para el subsector de usuarios finales.	7 320 000*
7.	Retroadaptación de usuarios finales en el subsector de refrigeración comercial.	4 500 000* (financiamiento solicitado de \$EUA 1.080.000)
8.	Programa de reemplazo/retroadaptación de enfriadores	3 900 000 (sin financiamiento solicitado)
9.	Equipos para servicio de HFC-134a	1 791 000
	TOTAL	21 901 000

*Se propone utilizar los fondos solicitados para el costo adicional de explotación para el subsector de usuarios finales para cubrir parte del punto 7, “Retroadaptación de usuarios finales en el subsector de refrigeración comercial”, por un monto de \$EUA 3.420.000 y parte del punto 8, “Programa de reemplazo/retroadaptación de enfriadores” (\$EUA 3.900.000), aplicando un sistema de fondos renovables.

4. Una descripción en cada uno de los componentes precedentes del Plan proporciona información sobre el consumo de SAO en cuestión y la metodología de cálculo del nivel de financiamiento, con inclusión de referencia a la decisión del Comité Ejecutivo sobre la que se basa el componente. Los costos de estos componentes se calculan sobre la base del consumo de 1998 en el sector de refrigeración, utilizando datos de 1998. Entre otras cosas, se usaron los precios del CFC-12 y HFC-134a en la frontera para calcular los costos adicionales de explotación.

5. Componente Nro. 1 - Eliminación de SAO en pequeños y medianos fabricantes de refrigeración comercial, cubre la conversión de los 325 productores restantes de unidades de refrigeración generalmente hecha de medida, tales como vitrinas refrigeradas, congeladores verticales, enfriadores de agua y conservadores refrigerados. Este componente cubre todo el consumo restante en el subsector de fabricación de refrigeración. La información sobre el equipo básico, la producción y el consumo de SAO se recopiló por medio de un estudio realizado

por el Banco Mundial en 1998. Esta información se utilizó en la preparación de tres proyectos generales presentados a la 27ª Reunión en marzo de 1999. Al momento de la presentación del Plan sectorial de refrigeración para Turquía (TRSP), se habían establecido comunicaciones con todas las PyMEs a fin de actualizar la información. Algunas empresas no completaron la actualización. Conforme al plan TRSP, las PyMEs consumieron 126,58 toneladas métricas de CFC-11 para operaciones con espumas y 184,62 toneladas métricas de CFC-12 y 9,78 toneladas métricas de R502 como refrigerantes. Las compañías se dispusieron en grupos que usan equipos similares. Este componente también incluye a 5 empresas que fabrican equipos de refrigeración para transporte. Se solicitan costos adicionales de capital para cada uno de estos grupos sobre la base de la participación de cada uno sólo en operaciones con refrigerantes o en operaciones tanto con refrigerantes como con espumas. Se solicitan costos adicionales de explotación durante dos años para cubrir los precios más altos de los productos químicos y los componentes.

6. Los Componentes Nros. 2, 3, 4 y 5 se han incluido generalmente en los planes de gestión de refrigerantes en muchos países que operan al amparo del Artículo 5, incluso en países con un consumo similar al de Turquía.

7. Componente Nro. 6 - El costo adicional de explotación para el subsector de usuarios finales se calculó en \$EUA 7.320.000 sobre la base de la diferencia en los precios actuales en la frontera entre los refrigerantes CFC-12 y HFC-134 en un período de dos años. La cantidad de refrigerante CFC-12 a ser recuperada y usada por el mismo usuario final se excluyó de este cálculo.

8. Componente Nro. 7 - Retroadaptación de usuarios finales en el subsector de refrigeración comercial, cubre el costo de la retroadaptación de 60.000 unidades de equipos de refrigeración comercial no unitarios con una carga media de alrededor de 1,5 kg de refrigerante. Se informa que las existencias totales son de alrededor de 1.100.000 unidades. El costo de la retroadaptación de las unidades de refrigeración cubre el cambio de lubricante, refrigerante, secador de filtro y válvula de expansión y mano de obra y asciende a \$EUA 75,00/unidad. El Banco Mundial indicó que había desarrollado estos costos tomando en cuenta la parte pertinente de la Decisión 28/44 acerca de las circunstancias para la consideración de la eliminación de SAO en el sector de usuarios finales de refrigeración. El costo total se calcula en \$EUA 4,5 millones, de los cuales se solicitan \$EUA 1.080.000 como subsidio. Los \$EUA 3.420.000 restantes serían financiados con el componente No. 6, costo adicional de explotación para usuarios finales, y utilizados para establecer un fondo renovable dedicado al resto de los usuarios.

9. El Componente Nro. 8 es un programa de reemplazo de enfriados propuestos para la ejecución por medio de un fondo renovable. El financiamiento de los \$EUA 3,9 millones para la actividad provendrá de la parte restante del componente Nro. 6, costo adicional de explotación para usuarios finales.

10. El Componente Nro. 9 cubre el costo de los equipos para el servicio de dispositivos a base de HFC-134a. Existe una red de talleres de servicio afiliados a los principales productores de dispositivos domésticos y comerciales, la mayoría de los cuales ya cuenta con los equipos necesarios. La propuesta solicita financiamiento para los equipos de carga y detección de fugas necesarios para manipular refrigerantes de HFC-134a en alrededor de 26% de los talleres restantes.

11. El Plan proporciona información sobre las políticas actuales del Gobierno de Turquía, que introdujo un sistema de cupos de importación en enero de 2000. Las leyes imponen restricciones a la importación de CFC para todas las aplicaciones diferentes del servicio de los equipos de refrigeración existentes.

12. El Plan incluye un cronograma de eliminación de SAO basado en la demanda de CFC de 1998, que asciende a 1.942 toneladas métricas, con un objetivo de cero demanda de importación en 2000. Se prevé que, después de 2004, toda la demanda de CFC sea cubierta por las SAO regeneradas. El Plan también incluye el desglose, en tramos anuales, del financiamiento de subsidio solicitado para la ejecución del plan TRSP, que enlaza las importaciones anuales máximas admisibles con la solicitud de financiamiento.

13. Los procedimientos generales de operación se describen en la sección sobre ejecución. Conforme a estos procedimientos, una vez que el financiamiento total sea aprobado en principio, los tramos se liberarán en forma anual, siempre que se hayan alcanzado los hitos previstos y se hayan verificado los resultados de la eliminación. El Plan indica que las modalidades de ejecución nacionales específicas para los diferentes subsectores han sido acordadas entre la Unidad Nacional del Ozono y la industria. Estas modalidades no se describen en el Plan. Se propone en enfoque de arrendamiento de equipos para la conversión de los fabricantes de refrigeración comercial pertenecientes a PyMEs. En el sector de recuperación/reciclaje, los propietarios de talleres de servicio han comenzado a firmar contratos de arrendamiento según el rendimiento del reciclaje.

COMENTARIOS Y RECOMENDACIONES DE LA SECRETARÍA

COMENTARIOS

14. La Secretaría ha realizado un examen preliminar del Plan sectorial de refrigeración para Turquía (TRSP), concentrándose en los elementos básicos y la admisibilidad de los componentes propuestos y teniendo en cuenta las políticas y directrices del Comité Ejecutivo existentes. En este examen, la Secretaría también tuvo en cuenta debidamente la aprobación del Comité Ejecutivo de planes RMP en muchos países que operan al amparo del Artículo 5.

15. El plan TRSP se basa actualmente en el consumo de SAO del sector en 1998. La Secretaría propuso al Banco Mundial que use los datos de consumo de SAO más recientes, de 1999 (es decir, \$EUA 741,4 toneladas PAO), como base para formular el Plan. Turquía informó datos de 1999 a las Secretarías del Fondo Multilateral y del Ozono. Todavía no hay datos de consumo de SAO de 2000 disponibles. Esta propuesta fue aceptada por el Banco. De conformidad con lo antedicho, se solicitó al Banco Mundial que revise el plan sectorial del modo pertinente.

16. La Secretaría analizó con el Banco la admisibilidad de los costos adicionales de explotación (IOC) para los usuarios finales, citando la Lista indicativa de categorías de costos adicionales, que no dispone que los costos adicionales de explotación se paguen a los usuarios finales de equipos que contienen SAO. Asimismo, el cálculo de los potenciales costos/ahorros futuros sería muy sensible a la diferencia en los precios de los CFC y sus sustitutos. Todas las

proyecciones para el futuro serían extremadamente especulativas. El Banco Mundial acordó excluir este componente del plan TRSP. Se solicitó al Banco Mundial que revise el plan sectorial del modo pertinente.

17. La Secretaría indicó al Banco que los equipos para la manipulación de sustitutos sin SAO en las operaciones de servicio en el subsector de usuarios finales no están incluidos en la Lista indicativa de categorías de costos adicionales. Por lo tanto, el costo de los equipos para el servicio de dispositivos a base de HCF-134a, tal como se incluye en el Componente Nro. 9, no resulta admisible para el financiamiento. El Banco acordó eliminar este componente en la versión revisada del TRSP. De conformidad con lo antedicho, se solicitó al Banco Mundial que revise el plan sectorial.

18. El componente para la conversión de las PyMEs del subsector de refrigeración comercial cubre a todas las empresas restantes y se podría considerar un proyecto general final, descrito en la Decisión 25/50, aún cuando el componente no esté incluido en el plan sectorial de este modo. La solicitud de conversión de las restantes PyMEs del subsector de refrigeración comercial se basa sobre la información obtenida por el Banco por medio de un estudio realizado en 1998. Esta información debe ser actualizada. El consumo total de SAO de parte de las PyMEs, tal como se indica en el TRSP, no guarda conformidad con el desglose del consumo total de 1999 en las aplicaciones específicas utilizadas en la preparación de los componentes del TRSP. El Banco está recopilando la información actualizada.

19. En relación con el componente Nro. 7: Retroadaptación de usuarios finales en el subsector de refrigeración comercial., la Decisión 28/44 estipula que: **“ya sea que ninguna otra actividad posible permitiría al país cumplir con sus obligaciones de control de CFC o los precios al consumidor comparativos de los CFC, en relación con los refrigerantes sustitutos, hayan sido altos durante 9 meses como mínimo y se espere que aumenten”**. Ninguna de estas condiciones previas parece corresponder a Turquía, ya que el análisis provisto en el documento UNEP/OzL.Pro/ExCom/34/16 incide que, si se presupone que no aumentará el consumo actual, Turquía habrá superado el objetivo de cumplimiento para 2005 en más de 1.000 toneladas PAO. También, el precio del CFC 12 es mucho más bajo que el de HFC-134a en Turquía.

20. Los precios de los CFC y sus sustitutos resultan importantes para calcular de manera exacta los costos y los ahorros adicionales. La información sobre los precios de los CFC y sus sustitutos en Turquía no parece guardar conformidad con el historial de precios del CFC y las circunstancias imperantes en el país. Se requieren más investigaciones. El Banco Mundial trabajará con el Gobierno de Turquía para proporcionar precios de mercado exactos y actualizados de los productos químicos pertinentes. Se utilizarán los datos exactos y más recientes para calcular los costos adicionales de explotación y evaluar la viabilidad de las operaciones de recuperación/reciclaje en la versión revisada del plan TRSP.

21. La Secretaría también formuló comentarios sobre la modalidad de ejecución que propone incluir disposiciones adicionales, entre otras cosas, sobre los arreglos para la ejecución propuesta para los subsectores diferentes de las PyMEs, reciclaje y enfriadores, las medidas legales, institucionales o de mercado y, lo que resulta importante, para la auditoría y verificación de los objetivos de cumplimiento y los resultados de la eliminación a cargo de expertos independientes

y su relación con las solicitudes de financiamiento anual propuestas. Si los objetivos de desempeño pertinentes (en especial, la cantidad objetivo de SAO a eliminar) no se alcanzan de conformidad con el cronograma propuesto, se deben invocar las medidas apropiadas, que deben estar incluidas en las propuestas como posibles cláusulas de penalidades.

22. Se debe revisar la propuesta. En este punto, la Secretaría no puede proceder a la revisión de los costos de los componentes individuales incorporados en el TRSP a fin de determinar el nivel de subsidio admisible. La Secretaría está a la espera de la recepción de la presentación revisada. La terminación de la revisión podría verse afectada por la disponibilidad de parte de la información esencial, tal como la información detallada sobre las restantes PyMEs. Se informará al Subcomité de examen de proyectos acerca de los avances de la revisión del plan TRSP propuesto.

PROJECT COVER SHEET

COUNTRY:	Turkey	IMPLEMENTING AGENCY:	The World Bank
PROJECT TITLE:	Refrigeration ODS Phase out Sector Plan		
PROJECT IN CURRENT BUSINESS PLAN:	Yes		
SECTOR/SUB-SECTOR	Refrigeration		
ODS USE IN SECTOR:	[1998]:	1,934 ODP tons	
PROJECT IMPACT	(CFC-11):	141 ODP tons	
	(CFC-12):	1,790 ODP tons	
	(R-502):	3 ODP tons	
REMAINING ODS USE IN SECTOR	[2005]:	0	
PROJECT DURATION:	48 Months		
PROJECT COSTS:			
Incremental Capital Cost	US\$ 12,642,000		
Contingency (10%)	US\$ Included above		
Incremental Operating Cost	US\$ 9,259,000 (US\$ 7,320,000 to be used for the revolving fund)		
Total Project Cost	US\$ 21,901,000		
LOCAL OWNERSHIP:	100 %		
EXPORT COMPONENT:	0		
REQUESTED MLF GRANT:	US\$ 21,901,000 (to be released in tranches for the entire sector plan.)		
IMPLEMENTING AGENCY SUPPORT COST:	US\$ 2, 797,600 (for the entire sector plan)		
TOTAL COST OF PROJECT TO MLF:	US\$ 24, 698,600 (for the entire sector plan)		
OVERALL COST-EFFECTIVENESS:	US\$ 9.50/ kg ODP		
STATUS OF COUNTERPART FUNDING:	Submission requested by the Government of Turkey		
PROJECT MON. MILESTONES INCLUDED:	Yes		
NATIONAL COORDINATING AGENCY:	Technology Development Foundation Of Turkey (TTGV)		

PROJECT SUMMARY

The refrigeration ODS phase-out sector plan covers a) remaining conversion of Turkey's refrigeration industry, basically app. 275 small and medium-sized manufacturer of commercial refrigerating equipment, b) equipment for proper HFC-134a servicing, c) training of refrigeration service technicians in improved service methods, d) end user conversion of commercial refrigeration equipment. e) a chiller replacement/retrofit program, f) establishment of a recovery/reclaim scheme for ODS and g) customs training and equipment for effective border control, Turkey has issued a regulation on import of ODS and ODS containing equipment becoming fully effective by January 1, 2000. Any future import of ODS will be based on a quota system, which was introduced in July 1998. Import quotas are already substantially reduced compared to 1998 import figures. In accordance with the proposal, Turkey will ban import of CFC-12 [including CFC for servicing] from year 2005. With approval of this sector plan and all its components, the Turkish National Ozone Policy will be strongly supported and the import of ODS can be eliminated due to reduced demand. Residual demand will be covered through the introduction of a recovery/reclaim scheme for ODS.

IMPACT OF PROJECT ON COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

While the subproject is not required to meet the 1999 freeze, it is a part of the overall strategy supporting the accelerated phase-out schedule which Turkey has adopted, and is consistent with the country program.

Prepared by: Ole Reinholdt Nielsen/ RE-A-CT, TTGV, World Bank

Date: Aug. 31, 1999

Reviewed by: OORG/Lambert Kuijpers and Mike Jeffs

Date: Aug. 1999

Turkey - Refrigeration ODS Phaseout Sector Plan

Original (31.08.1999)

Revised: April 2001

**SECTOR PLAN FOR PHASEOUT OF CFC CONSUMPTION
IN THE
TURKISH REFRIGERATION SECTOR**

PREPARED BY

TURKISH NATIONAL OZONE UNIT

AND

TTGV

WITH TECHNICAL ASSISTANCE FROM THE WORLD BANK

AUGUST 1999

UPDATED APRIL 2001

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5. Refrigeration Sub Sectors
6. Justification for Selection of Alternative Technology
7. Sector Plan Costs
8. Implementation

OORG review:

Annexes: 1: Overview over previous MLF funded projects in the Turkish Refrigeration Sector
2: Standard costs

Turkish Refrigeration Sector

1. INTRODUCTION

In accordance with its Country Program, Turkey has moved ahead with its national program for phasing out the use of Ozone Depleting Substances as presented to the Executive Committee of the Multilateral Fund at its 8th meeting in October 1992. Since then, Turkey has received a total of \$16.2 Million eliminating a consumption of 3,080 MT ODP. It has now reached a stage, where it is necessary to address the remaining ODS consumption in the refrigeration through an overall sector plan. This proposal include a sector plan for the refrigeration sector in Turkey.

Turkey ratified the Montreal Protocol on September 20, 1991 As Article 5 party to the Montreal Protocol,

Turkey ratified the Montreal Protocol on 20 September 1991 and was classified as an Article 5 country as the consumption per capita was less than 0.3 kg ODP/capita. Turkey qualifies for a grace period of 10 years in the Protocol's implementation schedule and is eligible for financial support and technical assistance from the Multilateral Fund (MLF) of the Montreal Protocol to reduce the financial impact to the country caused by the ODS phase out and introduction of substitutes. However, before ratifying the Protocol, Turkey passed a law in August 1991, creating a Ministry of Environment and adopted the Montreal Protocol ODS phaseout requirements as part of its regulation. In its Country Program, it examined two phaseout scenarios, an "allowable" phaseout schedule and an "accelerated" phaseout schedule. In the accelerated, 1998 is targeted as the phaseout year. Cost analysis identified and estimated the magnitude of various categories of costs associated with the phaseout and identified the accelerated as the least costly to Turkey and the Multilateral Fund. It was estimated that the accelerated phaseout schedule would costs US\$127 M while the slower schedule would costs Turkey over US\$230 million.

Turkey is not a producer of ODS, nor producer of any substitutes used for replacing of CFCs and halons. Turkey presented its country program to the Executive Committee of the Multilateral Fund in 1992. It aimed at an accelerated phase out schedule, virtually eliminating the consumption of ODS in Turkey by January 1, 2000. The base data on consumption of Annex A1 in Turkey is 3,805.3 MT ODS. Up to now, Turkey has received funding of a total of around US\$ 21 M eliminating around 1,500 MT ODS.

At the 27th meeting of the ExCom, Turkey submitted umbrella projects addressing the remaining consumption in the SME refrigeration sector. It also submitted projects for training and recycling to the secretariat for information purpose. In agreement with Turkey, the umbrella project was deferred. Instead a sector plan addressing the entire refrigeration sector was developed and submitted to the Multilateral Fund of the Montreal Protocol at the 29th meeting. ExCom decided that the refrigeration sector plan should be deferred, pending development of guidelines for such refrigeration sector plans. However, as Turkey had been following its country program original developed, submitted and reviewed by the Executive Committee, Turkey has moved ahead in accordance with its national ozone program.

While the approval of the refrigeration sector plan was put on hold pending development of new guidelines by the MLF, Turkey has implemented the policies as planned and put in place its ozone substance import control regulations and limited the supply of ODP's. The industry had to respond to the national laws and regulations and has moved ahead with its conversion, forced by the national program.

2. OBJECTIVES OF THE PROPOSAL

The objective of this sector plan is to complete the phase-out of the use of ODS in the refrigeration sector in Turkey, which consumes app. 1,950 MT ODS in 1998. (Import of CFC-12 in 1999 is reported as 736 MT). The refrigeration ODS phase-out sector plan consist of a combination of policies and regulations,

financial support in order to limit phase out costs to the industry, a recycling program to eliminate import of ODS when the sector plan has been implemented, an implementation modality and a monitoring program

Activities necessary to fulfill the objectives are outlined in the following and consist of these eight main components: A) Conversion of the remaining producers of commercial refrigerating equipment, B) Train and re-educate enterprises and shops engaged in servicing ODS and non-ODS based refrigeration equipment, C) Establish a national capacity for servicing HFC-134a based refrigeration equipment, D) Retrofit and replace existing refrigeration equipment in order to reduce future demand for ODS, E) a chiller replacement/retrofit program, F) Recover and reclaim CFC-12 as part of a national recycling program, G) Training of custom authorities for enforcement of import control regulation, H) Establish technical capacity to implement and monitor the ODS phase out sector plan.

Within the context of this refrigeration sector plan, activities being put in place for this year will phase-out 1,216 MT ODP and additional 740 MT in 2005, hence the CFC-12 consumption will be zero (0) from year 2005 and forward. Approval of the sector plan will provide strong support for the implementation of the Turkish Ozone Policy as presented in its country program.

With approval of funding to support all components of this Refrigeration ODS Phase out Sector Plan for Turkey, there will be no further request from Turkey for ODS phase-out in the refrigeration sector.

While the project by project approach has assisted Turkey in converting the larger companies in the commercial and domestic refrigeration sector, little help has so far been provided to the large number of small companies involved in the refrigeration sector in Turkey. It was also recommended by ExCom when projects for the larger companies was approved that funding for the servicing part should be requested later and as a package addressing servicing. This sector plan addresses the remaining CFC consumption in the refrigeration sector. Consumption is defined as need for import of newly produced CFC for production of new refrigeration equipment and servicing of existing CFC based refrigeration equipment. However, import might not translate into a use in the same year and the discussions of production closures in Russia, India and China.

The remaining consumption and actions proposed are addressed for each refrigeration sub-sector in the Turkish Refrigeration Sector Plan, TRSP. The sector plan is addressing remaining consumption in the following subsectors:

- Commercial refrigeration equipment manufacturing sector.
- MAC sector.
- Transportation refrigeration sector.
- Chiller sector.
- Refrigeration end user sector, e.g. Supermarkets, Cold storage facilities.
- Recovering and recycling for servicing of existing refrigeration equipment.
- Training and technical assistance

The implementation of the program is the responsibility of the Turkish government. Turkey has the necessary technical capacity and experiences from the previous activities to implement this TRSP. The Bank will, as implementing agency, monitor and supervise the implementation of the Sector Plan and provide technical assistance as needed and requested by Turkey.

The implementation of TRSP will be monitored based on agreed annual targets and milestones. The bank will submit annual report to the MLF and request for release of funding for following activities in accordance with the agreement reached between Turkey and Executive Committee of the Multilateral Fund.

3. THE TURKISH REFRIGERATION SECTOR

The total number of enterprises in the refrigeration sector is estimated at 2500 to 3000 enterprises with a total number of employees of around 5,000 to 7,500 people. Majority of these enterprises are involved with service operations only and approximately 10% is producers of refrigerating appliances. This does not include insulation PU foam producers who supply insulation foams to many of the smaller commercial refrigeration workshops. The ODS consuming products cover all types of refrigeration appliances, ranging from small household refrigerators through commercial refrigeration units to chillers and cold storage facilities. Mobile air conditioning and transportation refrigeration for trucks and railways are also major ODS consumers in Turkey.

3.1 ODS consumption and the refrigeration sector

The ODS consumption in MT as reported to the Montreal protocol is shown in the table below. The table also shows the estimated ODS consumption in the refrigeration sector and the ODS consumption captured by previous MLF supported conversion projects. It should be noted that the consumption is defined as import minus export, not actual “consumption” by enterprises. Based on recent investigation, it seems that a number of importers and dealers imported CFC’s anticipating increased prices and shortcoming of supplies due to the announced stop of production in Russia and reduced CFC production in China and India.

Table 1: ODS Consumption as reported to the Ozone Secretariat of the Montreal Protocol, UNEP.

	1991	1992	1993	1994	1995	1996	1997	1998	1999*
ODS consumption *	2833*	3704*	2,359	2655*	3,798	3,765	3,876	4,022	
ODS for the refrigeration sector	879*	1226*	1,814	2054*	1,629	1,265	1,405	1,799	
Captured through MLF funded projects	0	655	0	327	0	64	36	0	

*) Data from 1996 study, see table 2B.

The formal definition of consumption by the Montreal Protocol is as Turkey does not have any production of ozone depleting substances, consumption would be equal import minus export. The definitions does, however, not take into account that some import might be stored, carried over from one year to the next and used by enterprises in the following years. Hence “consumption” data reported to the Ozone secretariat might not necessarily match actual consumption data collected from manufacturing enterprises and servicing companies. Furthermore, the use of 3 year average consumption data to determine the consumption by an enterprise also contribute to differences between “consumption” data reported to the Ozone Secretariat and consumption data generated from enterprise surveys.

Consumption figures as reported to the Secretariat of the Multilateral Fund are shown in the table below:

Table 2A: Consumption figures for the refrigeration sector as reported to the Secretariat of the MLF.

	1995	1996	1997	1998	1999
CFC-11	Small	small	0	0	0
CFC-12	1644	1279	1419	1796	736

Table 2B: Consumption of ODS in Turkey as reported in the “ODS Phaseout in Turkey: A Strategy Document”*.

	1991	1992	1993	1994
Total CFC consumption	2833	3704	3885	2665
CFC-11	75	102	541	631
CFC-12	804	1124	1225	1423

*Prepared for the Ministry of Environment, Republic of Turkey, prepared by Metroeconomica Limited Economic Consultants, by October 1996.

The historic data (1991 to 1993) was estimated by the MoE. Since 1993 MoE has been licensing the imports of substances and 1994 figures are based on licensing applications. From 1994, the custom data appears to be lower than the licensing data. This has been explained by the fact that until 1999, there were no requirements linking import licensing to actual utilization of import. A company could obtain import licenses, but might not have fully utilized them.

An overview of previous MLF funded projects in the refrigeration sector is provided in Annex 1.

In accordance with the Montreal Protocol, Turkey as well as all other Article 5 Parties to the Protocol must have the 1999 freeze requirement by July 1999 and limit its future ODS consumption to a maximum of the average 1995, 1996 and 1997 ODS consumption, i.e. maximum of 3,813 MT. However, in accordance with the country program, Turkey has decided on an accelerated ODS phase out schedule and planned to eliminate import of ODS from January 1, 2000, except from some residual demand for refrigeration, halons, solvents and aerosol uses. The TRSP was prepared based on 1998 data and submitted in 1999. The new figures clearly document the Turkish commitment to the implementation of the original country program and the refrigeration sector plan. Delays in fully implementing the original phase-out plan is mainly due to the delays caused by the MLF process.

3.2 Remaining ODS consumption

Based on data from all major manufacturers of refrigerating appliances in Turkey, the survey for SME's in the sub-sector of commercial refrigeration as well as relevant organizations, e.g. ISKID, (who covers all installers of larger refrigeration equipment, cold stores, chillers etc., in Turkey), the remaining ODS consumption has been estimated.

Table 3A: Remaining CFC consumption in the refrigeration sector.

Type of appliance	Stock	Initial charge	Service demand	Lifetime
Domestic refrigerators and freezers	19,000,000	0.2 kg/unit	10% per year	10-15 years
Unitary commercial refrigerating appliances	1,700,000	0.4-0.8 kg/unit	25% per year	5-10 years
Commercial refrigerating appliances produced by SME's	1,100,000	1.0-2.0 kg/unit	25-50% per year	10-15 years

Cold stores	6,000	1-5 kg/unit	25-50% per year	10-15 years
Water chillers	10,000	150-200 kg/unit	40% per year	10-20 years
Supermarket systems	10,000	1-5 kg/unit	25-50% per year	10-15 years
Mobile AC units	236,000	1 kg/unit	40% per year	8-10 years
Transport refrigerating systems	103,000	2-5 kg/unit	25-50% per year	8-10 years
Domestic AC units	100,000	1 kg/unit	25% per year	8-10 years
Split type AC units	850,000	3 kg/unit	25% per year	8-10 years
Packaged AC units	4,000	5-10 kg/unit	25% per year	8-10 years

Applying an average initial charge as well as an average leakage rate, the inventory of ODS as well as the ODS consumption relating to servicing can be estimated:

Table 3B: Remaining CFC consumption in the refrigeration sector.

Type of appliance	Stock	Share using ODS	ODS inventory in MT	ODS service demand in MT
Domestic refrigerators and freezers	19,000,000	70%	2,660	266
Unitary commercial refrigerating appliances	1,700,000	70%	714	179
Commercial refrigerating appliances produced by SME's	1,100,000	80%	1,320	495
Cold stores	6,000	50%	9	3
Water chillers	10,000	20%	350	140
Supermarket systems	10,000	50%	15	6
Mobile AC units	236,000	100%	236	94
Transport refrigerating systems	40,000	80%	112	42
Domestic AC units	100,000	0%	0	0
Split type AC units	850,000	0%	0	0
Packaged AC units	4,000	0%	0	0
Total			5,665	1,318

Based on previous tables, the annual consumption of ODS for new products is estimated at 141 MT CFC-11, 206 MT CFC-12 MT and 11 MT R-502 (pro-rated for the 33 companies that refused to cooperate), while the demand for servicing is estimated as 1,318 MT CFC-12. The total installed amount of CFC-12 in Turkey is estimated at 5,665 MT CFC-12.

Detailed information for each of the refrigeration sub sector provided in chapter 5.

4. THE TURKISH REFRIGERATION CFC PHASEOUT SECTOR PLAN

As the Government already has already established the necessary policies and regulatory measures, including an import control and quota system, the focus of the TRSP is to implement the actions needed to complete the phaseout of the CFC-12 and support the conversion to non-ODS substances. The TRSP is also considered as an important measure to help the industry keep its demand of CFC's in line with the deminishing supply of CFCs that is the result of regulatory measures introduced by the Government. This is to preempt an incentive for smuggling CFCs

The Refrigeration CFC phaseout program is presented in table 3 below. The schedule is, with a few modifications, identical to the original schedule submitted to ExCom in 1999. It should be noted that given that the Turkish government views this issue as being important and wanting to be proactive, has encouraged many of the enterprises to take actions based on the original plan submitted in 1999 and announcements made by the Government regarding control of CFC-12 imports. A survey has been undertaken to update the enterprise level information in the 1998 umbrella projects and the 1999 sector plan. The result is incorporated in the updated sector plan. Due the delay in the approval of this plan, a two step approach has been adopted by many refrigeration manufacturing companies and servicing companies. The first step has been to change servicing practice from CFC-12 and to HCFC-22 and HCFC blends for servicing purpose. This is, however, against the overall policy of the government, who sees a conversion to HFC-134, R404 blends and hydrocarbons as preferable. It is also creating technical problems through compressor failures and higher energy consumption. The survey has also shown that CFC prices has remained stable in 2000 and has not been the driving factor yet.

Table 4: Proposed ODS phase out schedule

	1998	1999	2000	2001	2002	2003	2004	2005
ODS consumption, manufacturing sector[MT]	358	358	300	250	150	0	0	0
ODS service demand [MT]	1,584	1,400	1,318	1,136	950	847	732	633
Total ODS demand [MT]	1,942	1,758	1,618	1,386	1,100	806	701	633
Reclaimed ODS [MT]	0	0	0	0	411	513	566	661
ODS import demand [MT]	1,942	1,758	1,618	1,386	689	334	166	0
Import Control and Quota System	Effective							
Policy framework		Effective						
SME conversion program			Starting	Ongoing	Completed			
Reclaim and recycling program					Starting	Ongoing	Ongoing	Ongoing
Chiller replacement program					Starting	Ongoing	Ongoing	Ongoing
End-user retrofit program						Starting	Ongoing	Ongoing

* Due to the foreseen stop of CFC production in Russia and reduced production in India, some importers has stockpiled CFC's to secure supply.

After year 2004, Turkey will not need further ODS import for the refrigeration sector. All needs will be covered by reclaimed ODS.

The break down in annual tranches of grant funding requested for implementing the TRSP is shown in the table below, linking maximum allowable annual imports to funding requests.

Table 5: Annual grant financed activities

Year	Activities to be funded	Maximum Import Allowed	Funding requested
2001	SME conversion program Dom Ref Service Shops Recycling and reclamation	Maximum of 700 tons CFC-12 allowed	US\$ 5.00 million
2002	Recycling and reclamation program Training and technical assistance Chiller replacement/retrofitting program	Maximum of 360 tons CFC-12 allowed	US\$ 5.00 million
2003	Recycling and reclamation program Training and technical assistance program Chiller replacement program* Com. Ref. End-user conversion program*	Maximum of 110 tons CFC-12 allowed	US\$ 5.00 million
2004	Recycling and reclamation program, ongoing; Chiller replacement program, ongoing*; End user conversion program, ongoing*	Maximum of 50 tons CFC-12 allowed	US\$ 5.00 million
2005	Chiller and Com Ref end user conversion programs, ongoing*	No import	US\$ 1.901 million
2006-2007	Recycling and end user program	No import	
Total costs:			US\$ 21.901 million

The end user conversion, covering both commercial refrigeration and chillers are based on the implementation of a loan program. The funding requested is equal the incremental operating costs related to substituting CFC's with HCFC-22, HFC-134a and R404.

Table 6: Loan (IOC) financed activities

Year	Activities to be funded	Maximum Import Allowed	Funding requested
2002	Recycling and reclamation program Training and technical assistance Chiller replacement/retrofitting program	Maximum of 360 tons CFC-12 allowed	US\$ 2.00 million
2003	Recycling and reclamation program Training and technical assistance program Chiller replacement program, ongoing* Com. Ref. End-user conversion program*	Maximum of 110 tons CFC-12 allowed	US\$ 2.00 million
2004	Recycling and reclamation program, ongoing; Chiller replacement program, ongoing* End user conversion program, ongoing*	Maximum of 50 tons CFC-12 allowed	US\$ 2.00 million
2005	Recycling and reclamation program, ongoing; Chiller and Com Ref end user conversion programs, ongoing*	No import	US\$ 1.32 million
2006-2007	Recycling and end user program Chiller and Com Ref end user conversion program, ongoing*	No import	US\$ 0
Total costs:			US\$ 7.320 million

Incremental operating costs associated with implementation of the program consist of the following elements:

Table 7: Incremental capital costs:

Year	ICC, grant financed	ICC loan financed	Total
2000	0.00	0	0.00
2001	5.00	0	5.00
2002	5.00	2.0	7.00
2003	5.00	2.0	7.00
2004	5.00	2.0	7.00
2005	1,901	1.320	3.221
	21.901	7.320	29.221

The requested incremental capital costs is based on present guidelines and policies as adopted by ExCom. It should be noted that the loan financed part is to be financed through the IOC costs.

Table 8: Incremental operating costs

Year	Chemical costs without sector plan	Chemical costs with sector plan	IOC
2002	4,209,142	8,437,111	4,227,969
2003	4,298,318	8,507,996	4,209,678
NPV of IOC for 2002 and 2003			7,320,000

The government of Turkey is requesting incremental operating costs for a 2 years period. The incremental costs is based on border prices for CFC-12 and substitute, HFC-134a. Price for substitute is based on same principle and comparable. CFC prices in the local market might be higher over time due to import restrictions. The IOC will be used for funding the loan program and will not be passed to the manufacturers or end users.

4.1 POLICIES AND REGULATIONS

When the Turkish country program was developed and adopted in 1992, Turkey decided on a very aggressive CFC phase out program, aiming at year 2000 for a total phase out of CFC for new refrigeration products.

The phaseout program was proposed to be supported by a combination of national policies and regulation and financial support from the Multilateral Fund of the Montreal Protocol and institutional capacity building. The most important among the National Ozone Policies envisaged was control of imports of CFC's and CFC containing equipment.

The major regulation is the Turkish National Ozone Policy, which was published in the official gazette by the end of July 1999. However, the National Ozone Policy actually came into force in 1998, where a quota system for import of ODS and ODS containing equipment was introduced. The import quotas have been adjusted on a regular basis and latest adjustment was in July 1999. The import quotas have significant impact on amount imported and thereby also on prices of ODS.

The National Ozone Policy ban imports of ODS and ODS containing equipment by January 1, 2000. Exemptions are made for essential use (laboratories) and for servicing of existing ODS containing appliances.

The National Ozone Policy includes a strong monitoring function, where all importers of ODS shall report their imports from 1996 as well as their clients. In addition to this the Turkish Customs Authorities will implement a monitoring and reporting system. A database will be available with all ODS import/users records. This system has already operational since the end of 1999.

This refrigeration sector plan is designed to be consistent with the Turkish regulation relating to ODS. As mentioned earlier, the national regulations and policies have forced enterprises to either convert at own costs or violate the national regulations. In some cases, the result have been lack of willingness to provide information on present CFC consumption due to non ozone related concerns over use of such information.

5. REFRIGERATION SUB SECTORS

5.1 Producers of refrigerating appliances (and compressors)

Presently, a total of more than 2.4 million household refrigerators and freezers are produced annually in Turkey. The production of household refrigerators and freezers in Turkey has increased significantly, from about 965,000 units in 1990 to app. 2.4 million units in 1998. Based on information provided in 1993, approximately 20% of the refrigerators are exported to a number of countries, including non Article 5 countries such as USA, Germany, Great Britain, Italy and France. The market is dominated by four major refrigerator manufacturers: Arcelik (PEE), PEG Profilo (Bosch Siemens), Pekel Teknik (Merloni) and Vestel.

The total annual production of unitary commercial refrigeration equipment at the major producers was about 215,000 units in 1998; the production consists of display cabinets and chests, cold drink dispensers etc. This type of commercial refrigerating units is produced by a few enterprises. MLF have already funded the conversion of majority of these producers, e.g. TEBA, Gümaksan, Külahcioglu, S.F.A., Klimasan and Ugur.

Remaining producers of refrigerating appliances in Turkey are mainly SME's producers, typically covering the market of custom-designed commercial refrigerating appliances like display cabinets and chests freezers, water coolers and cold stores. Based on investigations carried out in 1996 the total number of SME's engaged in such production was around 800 companies. However, the detailed investigation and survey undertaken by the end of 1998 covered around 325. According to information obtained, the difference is caused by a high number of bankruptcies during the economic crisis in 1997 and the recent earthquake. Further some companies have shifted into other operations. The 325 identified companies were visited as part of the development of the project proposals. Requested information on production volume, ODS consumption and baseline equipment was collected. While most companies were willing to provide full information, a few companies refused to cooperate.

Before resubmitting the TRSP, all SME companies has been contacted in order to update the information originally provided. The resubmitted sector plan is based on the updated information. At the time of submission, update was not completed for some enterprises. The remaining updates will be provided when completed.

While all companies included in the survey were engaged in production of refrigeration appliances, only some of them produced the insulation foam themselves. A large number of enterprises were buying the insulation foam from insulation foam producers.

The table 9A below summarizes the survey results, i.e. the companies' areas of activities and their ODS consumption related to production of refrigerating appliances in 1998.

Table 9A: Result of survey of SME refrigeration equipment manufacturing companies

#	Description	NUMBER OF ENTERPRISES	CFC-11	CFC-12	R-502	HCFC-22
1	Companies with refrigeration and PU foam operations (PU baseline)	17	53.47 MT	26.48 MT	1.61 MT	2.97 MT

2	Companies with refrigeration and PU foam operations (manual PU operation)	57	72.42 MT	50.47 MT	2.93 MT	9.62 MT
3	Companies with refrigeration baseline	113	0.04 MT	76.89 MT	3.68 MT	15.57 MT
4	Companies without refrigeration baseline	59	0.03 MT	24.53 MT	0.77 MT	5.53 MT
5	Companies using ammonia	6	NA	NA	NA	0.30 MT
6	Companies established after July 1995	21	0.02 MT	1.63 MT	0.12 MT	2.40 MT
7	Companies producing A/C units	5	NA	NA	0.05 MT	4.60 MT
8	Companies producing transport A/C units	5	0.60 MT	3.54 MT	NA	0.30 MT
9	Companies having only servicing operations	9	NA	1.09 MT	0.63 MT	4.68 MT
	Total	290	126.58 MT	184.62 MT	9.78 MT	45.97 MT
10	Companies not willing to provide information	33	NA	NA	NA	NA

5.1.2 Domestic refrigeration

The phase out plan is as follows:

Table 9B: Domestic refrigeration ODS phase out schedule:

	1998	1999	2000	2001	2002	2003	2004	2005
ODS service demand [MT]	340	306	275	233	204	178	156	136
Reclaimed ODS [MT]	0	0	0	0	176	193	207	231
ODS import demand [MT]	340	306	275	233	28	0	0	0

The domestic refrigeration ODS phase out plan is supported by:

- Re-education programme;
- HFC-134a servicing activity; and
- Recovery/reclaim activity.

5.1.3 Unitary commercial refrigerating appliances

The phase out plan is as follows:

Table 9C: Unitary commercial refrigeration ODS phase out schedule:

	1998	1999	2000	2001	2002	2003	2004	2005
ODS service demand [MT]	218	196	176	156	137	120	105	92
Reclaimed ODS [MT]	0	0	0	0	54	65	73	87
ODS import demand [MT]	218	196	176	156	82	55	32	5

The unitary commercial refrigeration ODS phase out plan is supported by:

- Re-education programme;
- HFC-134a servicing activity; and
- Recovery/reclaim activity.

5.1.4 Non-standard commercial refrigerating appliances (produced by SME's)

The phase out plan is as follows:

Table 9D: SME commercial refrigeration ODS phase out schedule:

	1998	1999	2000	2001	2002	2003	2004	2005
ODS for production [MT]	358	358	300	250	150	0	0	0
ODS service demand [MT]	534	481	453	434	379	332	290	254
Total ODS need [MT]	892	839	753	684	529	332	290	254
Reclaimed ODS [MT]	0	0	0	0	112	140	160	198
ODS import demand [MT]	892	839	753	684	417	192	130	56

The SME commercial refrigeration ODS phase out plan is supported by:

- SME conversion activity;
- Re-education programme;
- HFC-134a servicing activity;
- Recovery/reclaim activity; and
- End-user retrofit.

5.1.5 Compressor production and consumption

Compressors are supplied by Arcelik and imports from various manufacturers including Embraco, Danfoss, Necchi, Electrolux and Matsushita. TEE produced more than 1 million compressors in 1993, based on a license agreement with Tecumseh/USA. TEE have far the largest market share and most domestic refrigerators and freezers produced for the domestic market are equipped with compressors manufactured in Turkey by TEE (Arcelik). PEG Profilo, is the exception as its manufacturers most of the compressors used in their refrigerators.

Compressors for commercial refrigerating appliances are supplied by the local company, Arcelik, or imported e.g. from Danfoss, Necchi, Embraco, Aspera, L'Unité Hermetique, Maneurop or Copeland.

Table 9E: Compressor consumption in Turkey.

	Total consumption of compressors	Compressors produced in Turkey (1998)	MLF funded compressor production capacity
Compressors below or equal 250 W.	2,400,000 units	2,250,000 units	0 units
Compressor larger than 250 W.	400,000 units	0 units	0 units

5.1.6 Action Plan; Producers of refrigerating equipment

All remaining producers, i.e. the 323 SME's, will be covered by this activity. The refrigeration conversion will comprise the following equipment:

- Charging equipment, i.e. vacuum pump, charging glass or charging scale, charging manifold incl. gauges and hoses;
- Electronic leak detector

Companies, which do also have PU operations, will be covered by:

- High pressure foam dispenser.

Equipment will be replaced based on eligibility according to ExCom decision 20/72.

This activity is a continuation of two ongoing demonstration project for SME's in the sub-sector of commercial refrigeration with the aim to introduce cost effective ODS phase-out. One project carried out by Gazi University deals with the conversion from CFC-12/R-502 into HFC-134a/HFC-404A. The second project is carried out by Ispol and deals with cost effective conversion from CFC-11 into HCFC-141b for PU insulation foam.

Table 9F: Cost of converting the SME companies

Description	Total cost in US\$			Requested MLF grant in US\$		
	# of companies	Unit cost¹	Total cost	# of companies	Unit cost	Total cost
Companies with refrigerant and PU baseline (less than 10 years old)	17	29,000	493,000	17	29,000	493,000
Companies with refrigerant and PU baseline (more than 10 years old)	2	29,000	58,000	2	29,000	58,000
Companies with refrigerant but without PU baseline	50	29,000	1,450,000	49	29,000	1,421,000
Companies without refrigerant and PU baseline	15	29,000	435,000	14	29,000	406,000
Companies with refrigerant baseline	135	3,000	405,000	126	3,000	378,000

¹ According to Annex 2, standard costs

Companies without refrigerant baseline	74	3,000	222,000	66	3,000	198,000
Mobile A/C	5	3,000	15,000	4	3,000	12,000
Sub-total	298	3,078,000		279	2,966,000	
Contingency 10%	307,800			296,600		
Total	3,386,000			3,263,000		

5.2 MAC sector

The sub sector of servicing of mobile air conditions (MAC) comprises app. 760 companies all with contracts with the car manufacturer of Turkey. It has been assessed that the population of passenger cars with CFC-based MAC's is around 200,000 with an average charge of 1 kg and the population of light trucks/buses with CFC-based MAC is around 103,000. It is assumed that 40% of the full charge has to be replaced once a year yielding an expected consumption of app. 230 MT CFC-12 annually. Since beginning of 1995 all new MAC's on passenger cars and imported light trucks/buses are based on HFC-134a and it is assumed that the service companies are already trained and equipped to service these.

Furthermore a demonstration project financed by USEPA and UNDP is targeted at the MAC and transport refrigeration servicing, where the service companies of major manufacturer are covered.

It is expected that app. 10% of the stock of MAC's will be retrofitted or disposed annually and consequently the ODS consumption of the sub sector will be phased-out within 10 years.

MAC data and phase-out schedules are detailed in table 10A and 10B.

Table 10A : CFC MAC car population [passenger cars]

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Car sale	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
With CFC-12 MAC	100,000	100,000	100,000	100,000	0	0	0	0	0	0
CFC MAC population	100,000	200,000	300,000	400,000	360,000	324,000	291,600	262,000	236,000	189,000
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
CFC MAC Population	151,000	121,000	97,000	77,500	62,000	49,500	39,500	31,500	25,000	20,000
Service demand [MT]	60	48	39	31	25	20	16	13	10	8
Reclaimed [MT]	27	30	32	35	37	35	33	30	29	27
Import need [MT]	34	18	7	0	0	0	0	0	0	0

Table 10B: MAC ODS phase out schedule, [trucks and buses]:

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Vehicle sale	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
With CFC-12 MAC	35,000	35,000	35,000	35,000	5,000	5,000	5,000	5,000	5,000	0
CFC MAC population	35,000	70,000	105,000	140,000	131,000	123,000	115,500	109,000	103,000	82,500
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
CFC MAC Population	66,000	52,500	42,000	33,500	27,000	21,500	17,500	14,000	11,000	9,000
Service demand [MT]	86	69	55	44	35	28	23	18	14	12
Reclaimed [MT]	40	45	47	52	55	53	49	45	43	41
Import need [MT]	46	24	8	0	0	0	0	0	0	0

The MAC ODS phase out plan is supported by:

- Recovery/reclaim activity.

5.3 REFRIGERATION TRANSPORTATION SECTOR

The companies involved in the “transportation refrigeration” sector consist of companies who are manufacturing the refrigerating units as standardized units or special designed units and selling them as packages to installers. The units can be for either cooling or freezing units for trucks. The refrigeration units are installed in workshops around the country and some are exported to neighboring countries. 5 manufacturers of transportation refrigeration systems have been identified as part of the preparation of the sector plan of which 4 is using ODS as refrigerant and the 5th is using HFC-134a. The total annual production is app. 5,000 units. Each of them has their own manufacturing facility and is designing and testing systems before they are sold. They are also depending on their own development and testing. Some of them have their own network of workshops that install the refrigeration systems.

Table 11: Details on refrigeration transportation sector

Company name	Models produced	Production volume (1998)	CFC-12	R-502	HCFC-22	HFC-134a	HFC-404A	Other	CFC-11
Safkar ²	Bus AC Midibus AC Minibus AC P 220 P 320	1,34 3 1,17 6 738 743 440	14,000 kg	-	-	7,000 kg	-	-	500 kg ³

² Production comprises cabinet, frame, evaporator, condenser and electrical controls. Imported parts comprise compressor, drier, sight glass, expansion valve, hoses.

³ Consumed at sister company

Temtas ⁴	CS 1700 CS 2000 CS 3000	180 260 110	7,500 kg	-	450 kg	1,700 kg	210 kg	150 kg R-401A	6,000 kg
Termocold	N/A	25	400 kg	-	-	-	-	-	-
Termokold	N/A	47	517 kg	-	-	-	-	-	-
Konvekta	N/A	N/A	-	-	-	10,000 kg	-	-	-

Funding requested for the 5 manufacturers as commercial refrigeration projects.

Workshops for installation and servicing in accordance with the Decision.

Transportation sector: Decision 31/45, para 70:

As the decision was taken in July 2000, it would apply to the sector plan.

- A) to adopt for an 18 month period the guidelines for assembly, installation and charging equipment contained in Annex VIII.17
- B) to pay attention to project submitted under guidelines 3 and 4, in particular to determine whether there is any eligible incremental costs
- C) to consider projects on a case by case basis in order to gain experience

The activities of the enterprise involve design and manufacturing of complete refrigeration systems in its own central facility and under its own trade name (this could include refrigerated trucks, reach in refrigerators or freezers or small prefabricated cold rooms and a compressor size below 5 kW or less may be used to delineate the upper limit of “small” cold rooms:

Production capacity before 1995 can be established.

CFC consumption can be established through stable production and consumption records for ODS’s for a three year period (either the year prior to the project formulation or the average of the last three years will continued to be used to calculate consumption in projects).

Satisfactory guarantees can be provided that CFC based production will cease after conversion.

If not covered by the above, only capital costs will be covered. However, it is unlikely that there are any capital costs involved (item B)).

5.4 END USER CONVERSION

5.4.1 End-users

The typical end-users are supermarkets or shops like bakeries, groceries. The systems installed are usually plug-in type, but some central systems with wide distribution pipework are also available. Most products are produced in Turkey by either the larger companies like Klimasan or Ugur or by the SME’s. The total stock of unitary appliances is 1,700,000 units whereas the number of more individual types is estimated at 1,100,000 units. Average charge varies from 0.4 kg to several kg dependent on application. CFC-12 is the dominant refrigerant especially for the individual appliances.

⁴ Production comprises cabinet, frame, evaporator and condenser. Imported parts comprise compressor, drier, sight glass, expansion valve, hoses, electrical parts, pressure switches.

At the 28th meeting, ExCom decided for an initial period of 18th month, the relevant circumstances must prevail before priority will be accorded to end user conversion. The relevant circumstances are:

- the country should have import control on CFC's and CFC's based equipment in place and effectively enforce, and restrict deployment of new CFC components
- that, at the time of seeking compensation in form of grants for end users conversion, the country can establish that its major remaining consumption is for the servicing of refrigeration and air-conditioning equipment.
- To establish the above, that comprehensive data on the profile of all remaining consumption has been determined and made available to the ExCom;
- That either no other possible activities would allow the country to meet its CFC control obligations, or the comparative consumer price of CFC's, relative to substitute refrigerants, has been high for at least 9 months and is predicted to continue to increase.

The guidelines for an initial period of 18 month are:

- Retrofitting of commercial refrigeration equipment should continue to be assessed on a case by case basis;
- Training of refrigeration technicians should be recognized as part of end user conversion activities in the refrigeration sector;
- Retrofitting of commercial refrigeration equipment would be considered for funding based on the experiences gained from implementation of the relevant parts of a refrigeration management plan;
- for an initial period, priority should be given to projects for the conversion of cold stores in the agricultural, fisheries and other food –chain industries which are important for the economies of the country concerned;
- for the initial period, the costs associated with replacement of refrigerants, replacement of oil and minor capital items where necessary, and labor at local labor rate, will be eligible as incremental costs. More extensive conversion, including reconditioning or replacement of compressors and major overhaul of refrigeration systems will not be considered under the initial guidelines. Incremental costs and savings should be calculated as for other commercial refrigeration projects for a two year period:
- enterprise consumption will be the average annual quantity of CFC refrigerant which can be established as having been added to the refrigeration system as per existing EC guidelines;
- no cost-effectiveness guidelines needs to be established for this initial period but all existing baseline conditions and eligibility criteria will be applied. Funding for the initial period will be limited to US\$ 10 million.

The guidelines have not yet been applied. They are also going to be reviewed after 18th month.

In the TRSP, it is proposed to use a combination of grant and loan. The utilization of grant will be consistent with the guidelines. As it might be more cost effective to change to a non HCFC, additional costs not considered eligible by the guidelines will be covered through loan.

5.4.2 Action plan; End-user conversions

Turkey has a huge inventory of ODS in it's existing refrigerating appliances. The costs for conversion of this inventory is very high and Turkey may not be able to convert by it's own means. However, a conversion of the inventory will provide good support to the recovery/reclaim scheme foreseen, especially in it's first critical years of operation. This will again also strongly support Turkeys accelerated ODS phase out target.

When examining the end-user sector, the major potentials for recovery/reclaim are the larger and non-standardized systems. Hence, the following activities are foreseen.

The potential for retrofits is non-unitary commercial refrigerating appliances. A retrofit may compromise energy efficiency, which is essential for domestic- and unitary commercial appliances. Non-standard commercial appliances are more focused on function than energy efficiency, which makes them suitable for retrofit. In Turkey the non-standard commercial refrigerating appliances are mostly produced by SME's. The total stock is estimated at 1,100,000 units with an average charge of 1.5 kg refrigerant.

Retrofits of such installations involve a change of oil from mineral oil to polyester oil. Normally 3 oil changes are required to ensure that all mineral oil is removed from the system. Further the refrigerant shall be changed. Finally the filter dryer and potentially the expansion valve need to be replaced.

The objective of this activity is to retrofit app. 5% of the stock of non-standard commercial refrigerating appliances in Turkey. The activity will be implemented in two phases where phase I will retrofit 15,000 appliances and phase II will retrofit the remaining 45,000 units. The retrofit costs will be a combination of grant and loan (25% / 75%). The loan part will be paid to the revolving fund mentioned above, which will finance the retrofit of remaining non-standard appliances in Turkey. After phase I the scheme will be evaluated and adjusted if required.

The retrofit activity is closely linked to the re-education activity as proper training in retrofitting is a pre-condition for end-user conversions. Hence, the retrofit activity will start implementation 2 years later than the training activity.

The appliances to be retrofitted will be identified during the implementation of the SME conversion activity.

The requests for funding for end-user retrofit is based on ExCom decision 28/44.

The retrofit of 60,000 non-standard refrigerating appliances will recover 90 MT CFC-12, which can be used for other service purposes.

Table 12A: End-user retrofit

Description	Total cost in US\$			Requested MLF grant/loan in US\$		
	QTY	Unit cost	Total cost	QTY	Unit cost	Total cost
Replacement of oil and refrigerant	60,000	37.50	2,250,000	60,000	37.50	2,250,000
Replacement of filter dryer, expansion valve and labor costs	60,000	37.50	2,250,000	60,000	37.50	2,250,000
Subtotal			4,500,000			4,500,000
Contingency 10%			NA			NA
Total			4,500,000			4,500,000, hereof Grant: 1,080,000 Loan: 3,420,000

The end-user ODS phase-out plan is supported by:

- Re-education programme;
- Recovery/reclaim activity; and

- Chiller replacement activity.

The guidelines for the Transportation sector applies to cold room. And will be applied accordingly. The guidelines will be reviewed after 18th month, i.e. 2002. Any changes would apply to the TRSP.

5.4.3 Chiller replacement program

Chillers are used for centralized larger refrigerating systems either for air conditioning or for cooling purposes. A chiller is a complete unit that uses water as a secondary fluid to transfer the cold (for cooling purposes the water needs additives to lower the freezing point). Hence, the refrigerant charge for chillers is relatively low compared to the refrigerating capacity.

Chillers for AC purposes are usually equipped with turbo compressors, where chillers for cooling purposes can use reciprocating or screw compressors.

The chillers installed in Turkey use CFC-11, CFC-12, HCFC-22, HFC-134a and HFC-404A as refrigerant. The average charge is between 100 kg and 300 kg. The total stock of chillers is around 10,000 units of which app. 25% [2000] use CFC-11 or CFC-12.

Chillers are not produced in Turkey but imported from companies like York International, Carriers and Alarko. Import are handled through local agents. Chillers are serviced by engineering teams, associated with individual buildings or by the manufacturer's agent.

The phase out plan is as follows:

Table 12B: Chillers ODS phase out schedule:

	1998	1999	2000	2001	2002	2003	2004	2005
ODS service demand [MT]	175	158	142	123	107	94	82	72
Reclaimed ODS [MT]	0	0	0	0	30	38	44	55
ODS import demand [MT]	175	158	142	123	77	56	38	17

5.4.4 Chiller conversion

The stock of chillers in Turkey comprises 10,000 units of which app. 25% use CFC-11 or CFC-12 as refrigerant. The chillers have an average charge of 150 kg refrigerant.

The cost and distribution of chillers in Turkey is as follows:

Table 12C: Chiller costs

Chiller capacity	Price	Market share in Turkey
< 50 TR	15,000-25,000 US\$	30 %
90 TR	35,000 US\$	15 %
140 TR	50,000 US\$	20 %
195 TR	70,000 US\$	15 %
250 TR	100,000 US\$	7 %
330 TR	115,000 US\$	7 %
500 TR	125,000 US\$	4 %

> 700 TR	180,000 US\$	2 %
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Retrofit of chillers is likely into HCFC-123 as replacement for CFC-11 and HFC-134a as replacement for CFC-12. However, energy efficiency of a retrofitted chiller is normally reduced and hence, from a global environmental point of view, retrofit reduces the ozone depletion but increases the global warming.

Since compressors for chillers have undergone a significant improvement in terms of energy efficiency during the last 10 years, the best approach is to replace the chiller. Energy consumption is reported to be app. 10-15% less with a new chiller.

The objective of this activity is to replace 65 chillers. The replacement will be in two phases, where the first 25 chillers will be replaced in phase I and the remaining 40 chillers will be replaced in phase II. The activity will establish a revolving fund that provides interest free loans (up to 80% of the replacement costs) with a payback period of 4 years. After phase I the cash flow for the revolving fund will be analyzed and payback terms adjusted if required.

After completion of this activity the revolving fund will be used for replacement of remaining CFC-based chillers in Turkey.

The replacement of the initial 65 chillers will recover app. 11 MT CFC, which can be used for other service purposes.

Table 12D: Chiller replacement

Description	Total cost in US\$			Requested MLF loan in US\$		
	QTY	Unit cost	Total cost	QTY	Unit cost	Total cost
Chiller	65	60,000	3,900,000	65	60,000	3,900,000
Installation and commissioning	65	12,000	780,000	65	0	0
Subtotal			4,680,000			3,900,000
Contingency 10%			NA			NA
Total			4,680,000			3,900,000

The end user ODS phase out plan is supported by:

- Re-education programme;
- Recovery/reclaim activity; and
- Chiller replacement activity

5.4.5 Supermarkets

The phase out plan is as follows:

Table 12E: Supermarket ODS phase out schedule:

	1998	1999	2000	2001	2002	2003	2004	2005
ODS service demand [MT]	5	5	5	5	4	4	3	3
Reclaimed ODS [MT]	0	0	0	0	1	2	2	2

ODS import demand [MT]	5	5	5	5	3	2	1	1
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The supermarket ODS phase-out plan is supported by:

- Retrofitting
- Re-education programme; and
- Recovery/reclaim activity.

5.4.6 Cold Stores

The phase-out plan is as follows:

Table 12F: Cold store ODS phase out schedule:

	1998	1999	2000	2001	2002	2003	2004	2005
ODS service demand [MT]	4	4	3	3	3	2	2	2
Reclaimed ODS [MT]	0	0	0	0	1	1	1	1
ODS import demand [MT]	4	4	3	3	2	1	1	1

The cold store ODS phase-out plan is supported by:

- Retrofitting
- Re-education programme; and
- Recovery/reclaim activity.

5.5 REFRIGERATION SERVICING

5.5.1 Background

The sector of refrigeration servicing in Turkey comprises a huge number of smaller service companies. However, the majority of these have close relations to the large manufacturers of domestic and commercial refrigerating appliances. All the service companies are 100% Turkish companies and comprise usually 2-6 persons. A list of all service companies can be provided upon request.

The service companies can be grouped as follows:

- Companies with relations to the 4 producers of domestic refrigerators, i.e. Arcelik, Profilo (Bosch), Pekel Teknik (Merloni) and Vestel;
- Companies with relations to the producers of commercial refrigerators, i.e. Klimasan, Ugur, S.F.A and Külahcioglu;
- Small companies organized in Metal Goods Craftsmen Federation and other organizations where the major function is servicing of commercial refrigerating appliances but some of these companies do also have a minor production of customer designed commercial refrigerators.

Funding was requested together with the projects for the manufacturing companies. However, Excom decided that funding should only be provided when the conversion was completed and servicing of non ODS units was required.

5.5.2 Action plan for the servicing sector

This activity covers training by means of local experts of one representative of each company involved in servicing, 2,573 technicians in total. Each training session is foreseen to have duration of 5 days. The contents of the training will be based on UNEP’s training manual: “Good Practices in Refrigeration”, with additions applicable to Turkey, i.e. inclusion of flammable refrigerants and recovery/reclaim techniques. The training will be a combination of practical and theoretical training and will cover following topics:

- Environmental impact of refrigerants, ozone depletion and global warming;
- Alternatives to CFC and HCFC refrigerants;
- Replacement technologies;
- Retrofit procedures;
- Improved service methods;
- Servicing of appliances with flammable refrigerants;
- Recovery and recycling of refrigerants;
- Practical training in recovery of refrigerants.

The training will be conducted by local experts from KOSGEB, which is short for “Small and Medium Industry Development Organization”, a part of the Ministry of Industry. KOSGEB provides training in many different fields, e.g. hydraulics, pneumatics, computer programming, electronics and also in refrigeration- and A/C techniques. Annually 200 courses is conducted with a total number of 5000 participants.

The facilities at KOSGEB comprise 4 training centers located in Ankara, Istanbul, Izmir and Gaziantep. The training centers include 33 well-equipped laboratories, including a laboratory for refrigeration and one for A/C.

To facilitate the training the establishment of regional training centers is foreseen. Further, to ensure that the local experts are fully updated, both a train-the-trainer workshop as well as a study tour to a country where similar training activities are already implemented, is foreseen.

Table 13A, Training programme

Description	Total cost in US\$			Requested MLF grant in US\$		
	QTY	Unit cost	Total cost	QTY	Unit cost	Total cost
Establishment of training facilities	1	114,000	114,000	1	114,000	114,000
“Teach-the-teacher” workshop	1	27,000	27,000	1	27,000	27,000
Fee for trainers and project administration	1	405,000	405,000	1	405,000	405,000
Subtotal			546,000			546,000
Contingency 10%			54,600			54,600
Total			600,000			600,000

5.6 RECYCLING AND RECLAMATION

5.6.1 Recovery/reclaim scheme

This activity will establish a recovery/recycling/reclaim scheme for collection and cleaning of refrigerants. The scheme will initially be designed for CFC-12, R-502 and HCFC-22, but can later on be modified to also recover and reclaim HFC-refrigerants. As such the scheme will reduce both emission of ODS but also “greenhouse” gasses.

The scheme will include equipment for each service company, 2,705 in total, that will allow them to safely recover refrigerants when required. The equipment package will include:

- Recovery unit;
- Recovery cylinder with overfill protection;
- Piercing pliers and hoses; and
- Acid test kit.

Proper training in usage of the equipment will be provided as part of the training activity.

The technicians will bring the recovered refrigerant for recycling or reclaim at regional centers. It is foreseen to establish 9 reclaim centers and 19 recycling centers. Each center will be equipped with refrigerant identifiers for check of refrigerant mixtures. The reclaim centers will additionally also have gas chromatographs for more thorough analysis of refrigerant as well as equipment for filling of reclaimed refrigerant to cylinders.

Contaminated refrigerant not suitable for reclaim will be stored at a central storage.

Table 14: Recovery/reclaim scheme

Description	Total cost in US\$			Requested MLF grant in US\$		
	QTY	Unit cost ⁵	Total cost	QTY	Unit cost	Total cost
Service companies	2,705	1,475	3,990,000	2,385 ⁶	1,475	3,518,000
Reclaim units	9	45,000	405,000	9	45,000	405,000
Recycling units	19	3,500	66,500	19	3,500	66,500
Gas chromatographs	9	20,000	180,000	9	20,000	180,000
Refrigerant identifiers	28	1,000	28,000	28	1,000	28,000
Cylinders	500	200	100,000	500	200	100,000
Refrigerant cylinder filling equipment	9	30,000	270,000	9	30,000	270,000
Storage equipment	1	15,000	15,000	1	15,000	15,000
Exchange of experience	1	22,000	22,000	1	22,000	22,000
Project administration	1	18,000	18,000	1	18,000	18,000

⁵ According to Annex 2, standard costs

⁶ The service companies of Vestel have been deducted as they started their activities after 1996

Subtotal	5,094,500	4,622,500
Contingency 10%	509,500	462,500
Total	5,604,000	5,085,000

5.7 RE-TRAINING OF REFRIGERATION TECHNICIANS

5.7.2 HFC-134a servicing equipment

The main barrier for introduction of HFC-based refrigerating appliances in Turkey is the lack of guaranteed after-sales service. The major producers have now invested in HFC-134a servicing equipment for their service organizations, but there is still a substantial need for such equipment. Another problem which have been seen in some countries is switching back from HFC-134a to CFC-12 during servicing. While it has not been identified as an issue in Turkey, the training will address the issue and provide the necessary information regarding problems arising from such practice.

This activity covers one set of HFC-134a servicing equipment for each company engaged with service. Since, some of the companies are already having such equipment, only those not yet equipped will be requested funded.

The equipment foreseen comprise:

- Portable charging station for HFC-134a;
- Portable leak detector for HFC-134a.

The following table gives the status of HFC-134a servicing equipment at the service shops:

Table 15A: Servicing

Company	Number of service companies	Equipped for HFC-134a servicing	Not equipped for HFC-134a servicing
Arcelik	532	532	0
Profilo (Bosch)	398	398	0
Pekel Teknik (Merloni)	230	100	130
Vestel	320	0	320
Subtotal	1,480	1,030	450
Klimasan	260	260	0
Ugur	290	89	201
S.F.A.	270	270	0
Gümaksan	85	85	0
Külahcioglu	35	0	35
Subtotal	940	704	236
SME's	285	0	285
Total	2,705	1,734	971

Table 15B: HFC-134a servicing

Description	Total cost in US\$			Requested MLF grant in US\$		
	# of companies	Unit cost ⁷	Total cost	# of companies	Unit cost	Total cost
Service companies with HFC-134a servicing equipment	1,734	2,500	4,335,000	0	0	0
Service companies without HFC-134a servicing equipment	971	2,500	2,428,000	651 ⁸	2,500	1,628,000
Subtotal			6,763,000			1,628,000
Contingency 10%			243,000			163,000
Total			7,006,000			1,791,000

5.8 Institutional and technical assistance activities

Following supporting activities are foreseen in the sector plan:

5.8.1 Customs training

Turkey is in the process of implementing a customs monitoring system, where customs officers via Internet report on import/export of ODS and ODS containing equipment. However, since Turkey is surrounded by countries, where the usage of ODS may be allowed for another 10 years, an effective border control will reduce illegal trade.

This activity will cover a one-day training program of 1,000 custom officers in identifying ODS and will provide equipment for Turkey's 200 customs offices for such control. This activity will be built in the monitoring system mentioned above, so that illegal import will be reported as well.

Table 16, customs training

Description	Total cost in US\$			Requested MLF grant in US\$		
	QTY	Unit cost	Total cost	QTY	Unit cost	Total cost
Refrigerant identifiers	200	1,000	200,000	200	1,000	200,000
Training of 1,000 custom officers	1	80,000	80,000	1	80,000	80,000
Subtotal			280,000			280,000
Contingency 10%			20,000			20,000
Total			300,000			300,000

⁷ According to Annex 2, standard costs

⁸ 1,734 companies have already HFC-134a servicing equipment. Further the service companies of Vestel (320 companies) are deducted, as they started operations after 1996.

5.8.2 Awareness, implementation and monitoring

The sector plan, especially activity 3.1, will cover many small companies with limited management. The implementation modality (please refer to section 8 for details) will require full-time staff for implementation management. Further a close monitoring is required to ensure success of especially the recovery/reclaim scheme.

Table 17 Awareness, implementation assistance and TA

Description	Total cost in US\$			Requested MLF grant in US\$		
	QTY	Unit cost	Total cost	QTY	Unit cost	Total cost
Awareness	1	100,000	100,000	1	100,000	100,000
Implementation assistance	1	200,000	200,000	1	200,000	200,000
Monitoring	1	100,000	100,000	1	100,000	100,000
Subtotal			400,000			400,000
Contingency 10%			NA			NA
Total			400,000			400,000

6. JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

The following technologies have been considered for the refrigeration conversion:

- HCFC-22, which is rejected due to its ozone depleting potential as well as expectations for market requirements for non-ODS products;
- Drop-in blends (HCFC-based) which are rejected due their ozone depleting potentials as well as expectations for market requirements for non-ODS products;
- Hydrocarbons like HC-600a (isobutane) and HC-290 (propane) which are rejected due to flammability. For domestic appliances, the risk of flammability is minor, as the refrigerant charge is small. Appliances produced by the covered enterprises have a substantial charge, and hence hydrocarbons are not applicable.
- HFC-134a and HFC-404A, which are selected, as they are non-ODS. Further, HFC-134a and HFC-404A are widely used as CFC-12/R-502 replacements, reasonable in price and comprehensive local experience exists. It is recognized that HFC-134a and HFC-404A contribute to the global warming, but for commercial refrigeration, where the refrigerant charge can be substantial, no other non-ODS can be applied for SME's.

The following technologies have been considered for the foam conversion:

- Pentane (n-pentane or cyclopentane), which is rejected due to high conversion costs as well as flammability;
- Water/CO₂, which is rejected due to poor insulation properties;
- HFC-134a, which is rejected due to high operational costs;
- Liquid HFC's, e.g. HFC-245fa, HFC-356 or HFC-365, which are rejected due to lack of commercial availability in Turkey;
- HCFC-141b, which is selected as conversion costs can be kept at a minimum, insulation properties are comparable to CFC-11 blown foam and experience in conversion exist locally. However, HCFC-141b has an ozone depletion potential and the companies will at a later stage convert again, likely into liquid HFC's, e.g. HFC-245fa, when these are commercially available in Turkey. The enterprises will do this second conversion at their own expenses.

Turkey is fully aware of the ExCom requirements regarding the use of HCFC. The National Ozone Unit will review use of HCFC during the implementation of the sector plan. Turkey have a preference for none ODS substances and will enforce the general policy when possible.

7. SECTOR PLAN COSTS

Top down approach:

Table 18: Sector Plan costs

Activity	Basis for estimates	Total phase out costs to Turkey [US\$]	Requested MLF grant [US\$]	Requested MLF loan [US\$]
Conversion of remaining industry based on overall ODS consumption figures	Phase-out of 141 MT CFC-11, 206 MT CFC-12 and 11 MT R-502 (discounted 72% due to ODP value of R-502)	3,386,000	3,263,000	0
	IOC	4,585,000	4,585,000	
	Total	7,971,000	5,325,000 ⁹	
Incremental operating costs	Incremental costs for refrigerants only (IOC for SME and IOC's relating to refrigerant for retrofit activity not included)	32,060,000 ¹⁰	7,320,000 ¹¹	0
Re-education scheme	2,705 technicians trained	600,000	600,000	0
HFC-134a servicing base	2,705 companies equipped with HFC-134a servicing equipment	7,006,000	1,791,000	0
Recovery/reclaim scheme	2,705 companies equipped with recovery equipment, 9 reclaim centers and 19 recycling centers	5,604,000	5,085,000	0
Chiller replacement activity	65 chillers @ US\$ 72,000/unit	4,680,000	0	3,900,000
Retrofit activity	90 MT @ US\$ 50/kg	4,500,000	1,080,000	3,420,000
Customs training activity	Training of 1,000 customs officers and procurement of 200 refrigerant identifiers	300,000	300,000	0
Awareness, monitoring, implementation TA		400,000	400,000	
Total sector phase out costs		63,121,000	21,901,000	7,320,000

⁹ Max to threshold

¹⁰ NPV for period 2001-2011

¹¹ NPV for period 2001-2002

**BREAKDOWN OF INCREMENTAL OPERATING COSTS FOR SME
(Summary)**

Incremental Operating Costs applicable for activity 5.1.6 Calculation is provided below.

Component	BEFORE CONVERSION			AFTER CONVERSION		
	Kg	USD/kg	Cost	kg	USD/kg	Cost
CFC-11	141,000	1.55	218,550			
HCFC-141b ¹²				119,850	3.05	365,543
Compressor	140,000	100.00	14,000,000	140,000	115.00	16,100,000
CFC-12	205,500	2.83	581,565			
R-502	10,000	10.19	101,900			
HFC-134a ¹³				184,950	5.26	972,837
HFC-404A ¹⁴				9,000	11.69	105,210
IOC per year						<u>2,641,575</u>
IOC						
				1 st year	2 nd year	
IOC				2,641,575	2,641,575	
Discount factor				0.91	0.83	
NPV of IOC				2,401,431	2,183,120	
NPV of IOC, for 2 years						<u>4,585,000</u>

¹² CFC-11 is replaced by 85% HCFC-141b

¹³ CFC-12 is replaced by 90% HFC-134a

¹⁴ R-502 is replaced by 90% HFC-404A

IOC applicable for the Turkish refrigeration sector is calculated as follows. The IOC relating to the refrigerant used by SME's as well as refrigerant relating to end-user retrofits is not included.

Table 19: Incremental Operating Costs

Sub sector	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Domestic	1,776,880	1,671,677	1,582,547	1,507,554	1,445,006	1,393,424	1,351,515	1,318,152	1,292,349	1,273,245	1,260,090
Unitary commercial	515,508	521,970	529,396	537,711	546,849	556,753	567,376	578,677	590,620	603,178	616,325
SME commercial	1,012,598	1,078,147	1,140,305	1,199,617	1,256,560	1,311,558	1,364,984	1,417,165	1,468,394	1,518,928	1,568,998
Cold stores	6,903	7,349	7,772	8,175	8,563	8,937	9,301	9,656	10,005	10,349	10,690
Chillers	271,600	291,778	310,786	328,805	345,994	362,492	378,420	393,889	408,994	423,818	438,439
Supermarket	11,505	12,248	12,953	13,626	14,272	14,896	15,502	16,094	16,675	17,248	17,817
MAC	266,208	258,278	251,935	246,860	242,800	239,552	236,953	234,875	233,212	231,881	230,817
Transport	402,194	386,522	373,984	363,954	355,929	349,510	344,374	340,266	336,979	334,350	332,246
TOTAL	4,263,397	4,227,969	4,209,678	4,206,302	4,215,973	4,237,122	4,268,426	4,308,773	4,357,227	4,412,998	4,475,422
NPV of IOC for 10 years	32,057,511										

7.1 Total costs

The total incremental project cost is **US\$ 21,901,000**. All project costs are incremental and they will not provide the enterprises with any benefits.

7.2 Investment costs

Investment and other one-time costs include costs for equipment, training and TA. Investment costs are estimated at **US\$12,642,000**.

7.3 Operating costs

Incremental operating costs is based on a two years (NPV) consistent with existing ExCom guidelines for calculation of incremental operating costs. The IOC is based on actual consumption at the time of approval and do not take into account any growth projection. Based on the existing guidelines of ExCom, the IOC amounts to **US\$4,585,000**, as well as **US\$32,060,000** relating to remaining refrigerating industry are covered by this sector plan. IOC relates to incremental costs of HCFC-141b, HFC-134a and R-404 as well as compressors (for SME's).

7.4 Cost effectiveness (CE)

Overall cost effectiveness based on ODS consumption in 1998, is estimated at **US\$9.50/ kg**. Consistent with existing ExCom guidelines, calculation of the costs effectiveness of the sector plan does not take into account funding provided a loan, nor funding for the recycling part of the project.

7.5 Proposed Multilateral Fund grant/loan

The proposed grant is **US\$21,901,000** and the proposed loan is **US\$7,320,000** (to be financed from IOC). Both are based on 100% Turkish ownership.

7.6 Incremental operating costs:

As addressed in chapter 6, HFC-134a is identified as the main substitute. Due consideration related to import of substitute chemicals is requested on a national level, not on an enterprise level. The funding will not be given directly to the companies converting, but will instead be used to establish a national revolving fund to supplement the existing fund and finance costs not funded due to MLF policies and guidelines, e.g. end user conversion, chiller conversion.

8. IMPLEMENTATION

The refrigeration sector plan is based on active participation from enterprises in the refrigeration sector. Instead of the traditional approach where enterprises are identified and individual projects prepared for each individual enterprise, the sector approach requires enterprises to be proactive and apply for funds based on rules and guidelines established as part of this program, consistent with MLF funding principles. The sector approach also requires substantial information and promotion of the refrigeration sector plan in order to ensure that the industry is fully informed about the phase out program, the short term and long term implication to the industry and the possibilities to obtain funding to cover some of the cost faced and problems encountered when CFC-12 is not longer available in Turkey.

This sector plan utilizes experiences gained from ODS programs carried out in a number of countries and implementation modalities developed to limit impact to the and reduce implementation costs to the country and to individual enterprises. The program also aim to utilizes the revolving fund mechanism set up in Turkey some time ago, however, due to legal constraints, a revolving fund will be set up specifically for the Refrigeration Sector Plan.

As the program covers a number of sub sectors with different profiles, requirements and problems are sub sector specific. The national implementation modality for the different sub sectors has been agreed with the Ozone unit and the industry for each individual sub sector.

The sector plan also set specific milestones to be achieved before MLF funds can be transferred from the World Bank to Turkey. This is done in order to prevent delays and safeguard MLF funds. Despite the amount of activities covered by the sector plan, the mechanism allows the Bank to closely monitor the implementation of each activities and measure progress against agreed milestones. Following has been agreed as milestones for the transfer of funds from the World Bank to Ozone Trust Fund in Turkey.

8.1 General

It is proposed that the following will be the general operational procedures:

Approval and release of funds from the Multilateral Fund to the World Bank:

1. The sector plan is reviewed and approved by the Executive Committee of the Multilateral Fund. It should be agreed that the total funding is approved in principle and tranches released on an annual basis, provided that the agreed milestones have been met.
2. A first tranche is release upon approval of the sector plan. Following annual tranches are to be release against verification that the a) the planned activities in the previous annual plan has been initiated and all contracts covering the planned activities has been signed and, b) the import of CFC has been kept at or below the agreed target for the previous year.
3. Annual reports and request for release of the next tranche will be submitted to the second meeting of the year, (i.e. in 2002, 2003, 2004 and 2005) by the WB on behalf of Turkey. The annual report will provide an overview over contracts signed, amount and CFC captured through the activity. The annual report will also report on verified import in the previous year.

Transfer of funds from the WB to Turkey:

4. Upon approval of each annual tranche, the Bank will transfer 50% to the Banks FI, TTGV, in Turkey

5. Additional 30% will be transferred from the bank to the TTGV when contracts for all activities has been signed.
6. The last 20% will be transferred from the Bank to the TTGV based on verification that the previous years CFC import target has been met.

Transfer of funds from the TTGV to beneficiaries will follow the agreement between the World Bank of the TTGV. Contract will be signed based on WB procurement rules and guidelines. Beneficiaries will be reimbursed based on verifiable documented costs as given in the contract in accordance with the normal Bank operation.

The basic information regarding the refrigeration sector has been established during the project preparation. More than 300 enterprises has been visited and basic data obtained. In addition more than 2,700 refrigeration service shops have been registered and baseline information obtained. Information regarding numbers of chillers and commercial refrigeration units installed has been obtained. This form the basis for the implementation of the Refrigeration Sector Plan. The agreed implementation modality for each sub sector are as follows:

Due to the complexity of the program and different problems in the various sub sectors,, the following will be the guiding principles for funding of activities and contracts at enterprise level:

8.2 Equipment Lease Approach for the conversion of SME refrigeration equipment manufacturing enterprises and transportation refrigeration companies:

- Advertising and promotion of the MLF funding and ODS phase out program are done through regional workshops and national newspapers and journals. All enterprises are invited to participate free of charge in refrigeration workshops through out Turkey. At the workshops, each enterprise are invited to register his interest in participate in the program and ask to provide baseline information. The information will be checked against information in the existing database established by TTGV during the project preparation.
- All enterprises are invited to submit request for funding based on specified guidelines, which includes standard costs for typical conversion costs items. Threshold will not be applied to SME's. In case the requested funding exceed the estimated costs, priority will be given to companies with least phase out costs per kg ODP. In order to ensure reach out, two rounds of invitations will be given. One within 6 month after approval of the program and a second one 18 month after approval.
- Only ODS consuming enterprises and enterprises in operation before July 1995 can participate. Each enterprise are requested to provide detailed information regarding baseline situation and ODP consumption. Information to be verified before contracts are signed with each enterprise.
- Equipment will initially be given to the enterprises on a **two year lease basis**. A nominal annual equipment lease cost of 30% of the equipment costs will be applied). The lease costs will be offset against [80%] of reported ODS consumption. If the annual consumption is less than [80%], the lease costs to the enterprise will be prorated, e.g. if the enterprise only consume [40%] in the year, 50% of the lease costs will have to be paid by the enterprise. After two years lease, with an average of [80%] ODS consumption, the ownership of the equipment will be free transferred free of costs to the enterprise. If less, the company can either pay the prorated costs or return the equipment to the TTGV.
- In order to limit the companies to deal with, it is proposed that a number of qualified suppliers will be selected through bidding. The selecting will included price as one parameter. The refrigeration companies will be able to obtain the equipment from one of the selected suppliers. TTGV will make the necessary financial and technical arrangements with the suppliers.

8.3 Performance Contract Approach for HFC-134a service shops and CFC-12 recycling centers.

Funding of service shops and recycling centers will be based on **performance contracts** as well. For HFC-134a service shops, the equipment will be provided on a lease basis and only transferred to the enterprises after two years, based on documented utilization of the equipment in accordance with at least [80%] of the initial estimated recycled amount.

Recovering and recycling of CFC's a key element in the refrigeration sector plan. In order to avoid disincentives to recyclers, it has been decided that equipment will be provided based on a "**2 year recycling performance**" **leasing contracts**. I.e. a recycler sign a contract to recover and recycle a certain amount CFC-12 for the first two years of operation. If the target is met, the equipment will be transferred free of charged to the enterprise. In cases where the target is not met, the recycling equipment will either be returned or can be procured based on a prorated costs. The rational behind the approach is that performance contracts provide an incentive to the enterprise and 2 years of operation seems to be a reasonable time to develop the activity.

8.4 Revolving Fund Approach for replacement of Chillers

As chillers constitute of the main CFC consumers in Turkey, it is not possible to implement a refrigeration sector plan without addressing CFC-11 and -12 chiller replacement. Based on information gathered on the use of chillers in Turkey, total amount is around 10,000 units of which 25% or 2,500 units are using CFC-12 as refrigerants. The main population of chillers are in Ankara, Istanbul and Izmir, hence the program will initially address chillers in those three cities only.

As replacement of chillers are economical beneficial due to energy savings. Based on information available from chiller suppliers, the owners will be able to recover an investment in a new chiller within 3 to 5 years depending on the actual circumstances. This chillers replacement program, it is assumed that replacement contracts will be signed between the building owners on the FI on the following terms:

- The program will cover up to US\$ 100,000 per chiller in order to replace an existing chiller. As the lifetime of chillers are assumed to be from 10 years to 20 years, it has been agreed that this program shall address existing chiller between 10 and 15 years old.
- The chiller/building owner will be invited to submit request for financial support for replacement of existing chillers meeting the general requirements. Fund will be released from the account in accordance with WB procurement rules. TTGV will, at the same time sign an agreement that the beneficiary, who will repay TTGV in four equal rates starting one year after the new chiller are operational. The beneficiary will pay TTGV a service fee of 3% p.a. of the balance of the account (similar to the present rules of the Turkish revolving Fund. Installation costs and other costs will be born by the beneficiary.
- Based on calculation, it will be possible to replace sufficient chillers to reduce CFC consumption and recover sufficient CFC-12 to meet the residual demand. Financial, following calculation have been made, showing that MLF funding of 3.9 million for a revolving fund are necessary to carry out the program.
- Technical assistance to building owners will be provided free of costs through the FI. Costs of technical assistance will be covered by the TRSP under the TA part of the program.

In year 2010, the total amount of chillers replaced under the program will be app. 250 units, or 10% of the existing stock of chillers. The program will continue as long as needed.

It is expected that 46 MT CFC-12 will be recovered and used for servicing of remaining systems.

8.5 Revolving Fund Approach for retrofitting of existing commercial refrigeration equipment:

Retrofitting of commercial refrigeration systems will be initiated after two years, i.e. when conversion of remaining producers are in progress and no new CFC based units can be sold in the market.

Financing will be based on the present guidelines through a combination of grants and loans as outlined in the previous sections. The grant component will be consistent with the guidelines given, while the loan component will be determined on a case by case basis. The revolving fund facility will be used for the purpose of commercial refrigeration equipment also.

8.6 Key Project Implementation Milestones

Table 21: Milestones

Milestone	Performance target	Amount (grant)	Amount (loan)
2001	Sector plan approved by ExCom and funding transferred to the World Bank. Import control policy in place and operational	US\$ 2,000,000	
	Announcement of refrigeration sector plan and regional technical and awareness workshops conducted. SME bidding completed and contracts with SME enterprises covering at least 300 MT ODP signed	US\$ 4,000,000	
	Refrigeration training facility established. Contracts signed with all reclaim/recycling centers and with all service shops.	US\$ 4,000,000	
	50% of service technicians trained.	US\$ 1,500,000	
	Chiller program started, contract for replacement of at least 25 chillers started.		US\$ 3,900,000
	Retrofit program started, contracts signed for at least 10,000 end-user retrofits.	US\$ 1,080,000	US\$ 3,420,000
	Import quota zero MT	US\$ 1,000,000	
	Project completed, i.e. - no ODS import; - All individual conversion projects completed; - Recovery/recycling program capturing at least 50 MT/year	US\$ 1,001,000	

8.7 Implementation schedule

MoE and TTGV, Mr. Senol Ataman will administer the project. The implementation schedule for proposed activities is as follows:

CHECK DATES

Table 22: Implementation Schedule

Tasks	2001				2002				2003				2004				2005				
	1Q	2Q	3Q	4Q																	
Fund																					
Activity 6.1 – SME conversion: - Contracts signed - Equipment delivered - Test and trials - Activity completed		X																			
Activity 6.2.1 – Re-education: - Establish of training facilities - Training start - Activity completed		X	X									X									
Activity 6.2.2 – HFC-134a servicing base: - Contracts signed - Equipment delivered - Activity completed		X	X	X	X		X														
Activity 6.2.3 – Recovery/reclaim scheme: - Contracts signed - Equipment delivered - Activity completed			X	X	X	X		X													
Activity 6.3.1 – Chiller replacement: - Contracts signed - Chiller replacement start - Activity completed		X		X																	X
Activity 6.3.2 – End-user retrofit: - Contracts signed - Retrofit start - Activity completed						X			X												X
Activity 6.4.1 – Customs training: - Contract signed (equipment) - Equipment delivered - Training - Activity completed		X		X	X	X	X	X													
Activity 6.4.2 – TA: - Awareness campaign - Implementation assistance - Monitoring - Activity completed	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X

OORG TECHNICAL REVIEW

Country: **Turkey**
Firms: **SMEs / Servicing companies**
Type: **Refrigeration Equipment Conversion / Servicing / Replacements / Retrofits**
Date: **August 1999**

RTU-UNWB-LK-99368-dl

Scope

The project under review is a follow up to a demonstration project (the installation of recovery equipment in a large number of small workshops in Turkey, and a limited number of recycling centres). This project proposal involves phaseouts, training, servicing HFC-134a, recovery and recycle, chiller replacements and retrofits.

1. Sector and Enterprise Backgrounds

From the proposal the project objective is clear. The commercial refrigeration enterprise background is of the SME type; it may well be that there are 290 remaining companies in Turkey. The tables that determine the servicing demand (probably via the ISKID organisation) seem reasonable for the leakage, i.e., service demand per year. Lifetime estimates are rather short (the 10 years minimum seems very short for domestic equipment, chillers etc.). It is also difficult to comment to the figure of 1460 ODP tonnes. There will also be provided training; in how far will training reduce the ODS demand? This would influence the table in section 3.

2. Project Description

The project description in principle is clear. However, it consists of many elements: training, HFC-134a servicing equipment, servicing companies (2705 c.q. 971), conversions of companies in an overall approach (298-279), recover and recycle equipment, chiller replacements and retrofits of certain types of equipment. The HFC-134a servicing part does not contribute to the ODS savings, however if this would be submitted as a separate project it would not be eligible, it therefore is more adequate to mention it here, possibly together with the training component.

3. Environmental impact

The proposal will reduce the ODS emissions to the atmosphere. Where it concerns HFC-134a, the refrigerant has no ODP, and acceptable other environmental properties (in particular it has a certain GWP but it is a generally accepted refrigerant).

4. Implementation timeframe

No comments.

5. Project costs

Project costs are given in section 6 and supporting elements are given in Annex 1.

A number of questions arise, which are difficult to answer if it should be based upon experience under the Multilateral Fund.

- Can the conversion of the remaining industry be calculated on the basis of US\$ 15 separately for CFC-11 and CFC-12 ? How does the figure of 3,385,800 relate to the figure of 6,200,000 given in section 6 ?
- Can all remaining workshops that have not been equipped for HFC-134a servicing be equipped independent from how other workshops were equipped for HFC-134a ?
- In how far is there a relation of the 2705 workshops to be equipped with recovery apparatus (and recycling equipment) to earlier initiatives for R&R at other servicing workshops?
- Chiller replacement projects have so far been approved twice. One on the basis of a loan, one on the basis of a grant in a bilateral project. It is not clear whether one can introduce a demo project for chiller replacements for 5% of the existing chillers at a cost of US\$ 4,680,000 without further financial information on the revolving fund. Should this part of the project not be based upon a loan ?
- It may be interesting to propose a end-user retrofit plan for 5% of the non-standard commercial appliances, but how are they selected, who is carrying out these retrofits, and where is the reference to US\$ 50 for a retrofit of one appliance.
- The project proposal calculates a cost effectiveness on the basis of a phaseout activity, on the basis of R&R which cannot be considered as an annual amount, and on the basis of unique chiller replacement and end-user conversion retrofit plan. It is not clear what the amount of ODS should be that needs to be used in the cost effectiveness calculation.

6. Recommendations

The fact that there are several questions that cannot be answered due to lack of experience, due to lack of information on eligibility etc. makes it difficult to recommend or not recommend the project.

For a certain part this project proposal can be endorsed provided that

- n The cost for conversion of all companies and the used separate cost effectiveness for foam and refrigeration part is clarified (why US\$ 15 ?);
- n The table on leakage and lifetime of equipment is referenced;
- n The table on recovered refrigerant is clarified, i.e., where do the reclaimed amounts come from, and what is the relation to recovery and recycle (is there a 344 ODP tonnes of reuse of recovered and recycled material in 2004 ?);
- n The relationship to other activities in the R&R sector are clarified.

A number of issues cannot be addressed by the reviewer and should be addressed under the MLF:

- n Is it possible to consider HFC-134a servicing the way it has been done ?
- n Is it possible to consider chiller replacements on this basis without a scheme for flow of funds; should there be an investment (or a loan) from the MLF ?
- n Is it possible to consider end user conversions at e.g., US\$ 50 per kg ?
- n How should the total ODP impact of the project be calculated ?
- n Should the project be subdivided in the different parts to increase transparency ?

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Annex 1: List of previous projects in the Turkish Refrigeration Sector funded by MLF

The following table summarizes MLF funded projects in the Turkish refrigeration sector since 1992.

Enterprise	EC APPROVAL	MLF GRANT	ODS phase-out	Status
Arcelik	Oct-92	5,271,596 US\$	600 MT CFC-11 55 MT CFC-12	Completed 1995
Profilo	Dec-94 (15 th Meeting)	856,910.20 US\$	200 MT CFC-11 90 MT CFC-12	Completed 1995
Merloni	NA	NA	NA	Rejected due to the ownership change
Klimasan	Dec-94 (15 th Meeting)	673,338 US\$	20.5 MT CFC-11 15.9 MT CFC-12	Completed 1995
Ugur Sogutma	May-96 (19 th Meeting)	1,166,455 US\$	64.3 MT ODP	Completed 1999
SFA	May-97 (22 nd Meeting)	389,832 US\$	20 MT CFC-11 5.3 MT CFC-12 3 MT MCF	Awaiting financial completion
Kulahcioglu	May-97 (22 nd Meeting)	60,840 US\$	2.2 MT CFC-11 2.0 MT CFC-12	Completed 1999
TEBA	May-97 (22 nd Meeting)	27,364 US\$	3.9 MT CFC-11	Completed 1999
Gumaksan	May-97 (22 nd Meeting)	35,195 US\$	1.9 MT CFC-11 0.6 MT CFC-12	Completed 1999
IOC for Profilo			NA	Awaiting approval
IOC for Klimasan			NA	Awaiting approval
Total		8,481,530 US\$	848.5 MT CFC-11 168.8 MT CFC-12 64.3 MT ODP 3 MT MCF	

Annex 2: Standard Costs

The following standard costs are applicable to the sector plan:

Recovery/recycling equipment:

• Recovery unit	1,250 US\$
• Recovery cylinder, 14 kg	100 US\$
• Piercing plier	50 US\$
• Hoses	50 US\$
• Acid testing kit	25 US\$
Total	1,475 US\$

HFC servicing equipment:

• Portable charging station	2,000 US\$
• Portable leak detector	500 US\$
Total	2,500 US\$

Foam production equipment for companies with PU operations:

• HP foam dispenser	25,000 US\$
• Test and trials (chemicals)	500 US\$
• Training	500 US\$
Total	26,000 US\$

Refrigeration equipment:

• Vacuum pump	800 US\$
• Charging glass or scale	800 US\$
• Manifold and gauges	300 US\$
• Hoses	100 US\$
• Leak detector	500 US\$
• Test and trials	250 US\$
• Training	250 US\$
Total	3,000 US\$

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