NACIONES UNIDAS

EP

Programa de las Naciones Unidas Para el Medio Ambiente

Distr.
LIMITADA

UNEP/OzL.Pro/ExCom/34/27
22 de junio de 2001

ESPAÑOL
ORIGINAL: INGLÉS

COMITÉ EJECUTIVO DEL FONDO MULTILATERAL
PARA LA APLICACIÓN DEL
PROTOCOLO DE MONTREAL
Trigésima cuarta Reunión
Montreal, 18 al 20 de julio de 2001

PROPUESTAS DE PROYECTOS: CHINA

El presente documento contiene los comentarios y recomendaciones de la Secretaría del Fondo sobre los siguientes proyectos:

Espumas:

• Eliminación de CFC-11 con HCFC-141b en seis empresas y eliminación de CFC-11 mediante conversión a tecnología de espumación acuosa en una empresa (proyecto general)	ONUDI
• Eliminación de CFC-12 en la fabricación de espumas de poliestireno extruido (EPS) mediante el uso de butano como agente espumante en 9 empresas (proyecto general)	ONUDI
• Costo adicional de explotación: sustitución de CFC-11 por HCFC-141b en la fabricación de espuma de PU pulverizada rígida para aislación en 26 empresas	ONUDI

Refrigeración:

• Sustitución del agente espumante CFC-11 por ciclopentano y del refrigerante CFC-12 por HFC-134a en la fabricación de refrigeradores domésticos en Shangling Electric Appliance (Group) Co. Ltd.	Banco Mundial

Plan sectorial

• Plan de eliminación de CFC-11 en el sector espumas en China	Banco Mundial

HOJA DE EVALUACIÓN DE PROYECTOS
CHINA

SECTOR: Espumas | Uso de SAO en el sector (1999): 19 162 toneladas PAO

Umbrales de rentabilidad del subsector: Poliestireno/Polietileno $EUA 8,22/kg; Rígidas $EUA 7,83/kg

Títulos de los proyectos:

a) Eliminación de CFC-11 con HCFC-141b en seis empresas y eliminación de CFC-11 mediante conversión a tecnología de espumación acuosa en una empresa (proyecto general)
b) Eliminación de CFC-12 en la fabricación de espumas de poliestireno extruido (EPS) mediante el uso de butano como agente espumante en 9 empresas (proyecto general)
c) Costo adicional de explotación: sustitución de CFC-11 por HCFC-141b en la fabricación de espuma de PU pulverizada rígida para aislación en 26 empresas

Datos del proyecto	**Subsectores múltiples**	**Poliestireno/polietileno**	**Rígida**
	General	**9 empresas**	**26 empresas***
Consumo de la empresa (toneladas PAO)	206,65	750,00	978,80
Impacto del proyecto (toneladas PAO)	191,60	750,00	891,40
Duración del proyecto (meses)	30	24	30
Monto inicial solicitado ($EUA)	1 661 447	5 056 864	5 361 113
Costo final del proyecto ($EUA):			
Costo adicional de capital (a)	566 000	5 148 600	2 996 000
Gastos imprevistos (b)	42 896	493 110	299 600
Costo adicional de explotación (c)	1 052 551	-584 846	5 361 113
Costo total del proyecto (a+b+c)	1 661 447	5 056 864	8 656 713
Propiedad local (%)	100%	100%	100%
Componente de exportación (%)	0%	0%	0%
Monto solicitado ($EUA)	1 661 447		
Rentabilidad ($EUA/kg.)	7,83	6,76	7,77
¿Financiación de contraparte confirmada?	Sí		
Organismo nacional de coordinación	SEPA		
Organismo de ejecución	ONUDI		

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

* El componente de costo adicional de capital del proyecto fue aprobado en la 32ª reunión. La ONUDI solicita aprobación del componente de costo adicional de explotación.

DESCRIPCIÓN DE LOS PROYECTOS

Antecedentes del sector

- Último consumo total de SAO disponible (1999)	67 580,00	tons. PAO
- Consumo inicial de sustancias del Grupo I del Anexo A (CFC)	57 818,70	tons. PAO
- Consumo de sustancias del Grupo I del Anexo A en el año 1999	42 983,40	tons. PAO
- Consumo inicial de CFC en el sector espumas	No disponible	tons. PAO
- Consumo de CFC en el sector espumas en 1999	19 162,00	tons. PAO
- Fondos aprobados para proyectos de inversión en el sector espumas hasta fines de 2000	$EUA 80 258 917,00	
- Cantidad de CFC que se eliminarán en proyectos de inversión en el sector espumas hasta fines de 2000	14 988,90	tons. PAO
- Cantidad de CFC eliminados mediante proyectos de inversión aprobados en el sector espumas hasta fines de 2000	7 953,10	
- Cantidad de CFC en proyectos de inversión aprobados en el sector espumas aún no completados hasta fines de 2000	7 953,20	
- Cantidad de CFC que queda por eliminar en el sector espumas a fines de 2000	No disponible	

1. El desempeño del sector espumas en China y la eliminación proyectada de SAO en el sector se basan en el consumo del sector en China en 1999, descrito en la actualización del programa de país de China. La eliminación de CFC-12 en el subsector del polietileno y el poliestireno está comprendida en el plan estratégico presentado por la ONUDI al Comité Ejecutivo en su 33ª reunión. El consumo restante de CFC-11 y el plan de eliminación se describen en plan del sector de espumas de poliuretano (PU) que presentará el Banco Mundial a la 34ª reunión.

2. Se han presentado a la 34ª reunión dos proyectos generales y el plan del sector PU. Además, la ONUDI ha presentado una solicitud de pago del componente de costos adicionales de explotación de un proyecto general sobre espuma rígida para 26 empresas, aprobado en la 32ª reunión. Los proyectos generales incluyen un proyecto de subsector múltiple que abarca seis empresas de espuma de poliuretano rígida y una empresa que produce espuma de poliuretano para revestimiento integral y un proyecto sobre espumas de poliestireno extruido que abarca nueve empresas. Se prevé que los proyectos generales eliminarán 941,6 toneladas PAO de SAO después de su ejecución, en un período de 30 meses en cada caso. La ONUDI presentó todos los proyectos de inversión, mientras el Banco Mundial presentó el plan de sector.

Subsectores múltiples

Proyecto general

a) Componente de espuma rígida

3. Las seis empresas de espuma rígida incluidas en el proyecto general (Hongyu, Longan, Songliao, Tianyun, Xinyang y Yizheng) consumieron en total 188,8 toneladas PAO de CFC-11 en la producción de vehículos refrigerados en 1999. Cuatro de las empresas (Longan, Songliao, Xinyang y Yizheng) utilizan surtidores de espuma pulverizada, una empresa (Tianyun) emplea surtidores de baja presión y una empresa (Hongyu) explota máquinas vertedoras de espuma en la instalación inicial.

4. Las empresas convertirán su producción del CFC-11 al HCFC-141b como agente espumante. El proyecto incluye costos adicionales de capital para las seis empresas, que ascienden a $EUA 751 000, cubriendo el costo de los surtidores de espuma pulverizada de alta presión y la sustitución de los surtidores de baja presión por otros de alta presión. Cada empresa solicita fondos para la puesta en marcha y los ensayos ($EUA 5 000 - $EUA 15 000) y para capacitación ($EUA 4 000 - $EUA 7 000). Cada empresa solicita costos adicionales de explotación de $EUA 4 959 a $EUA 268 820 por un período de dos años, debido al costo superior de los productos químicos.

b) Componente de espuma para revestimiento integral

5. Yinxian consumió 17,85 toneladas PAO de CFC-11 en la fabricación de espuma para revestimiento integral en aplicaciones de automotores en 1999. La empresa utiliza dos surtidores internos de baja presión y cinco moldes de inyección en la dotación inicial.

6. Yinxian eliminará el uso de CFC-11 convirtiéndose al HCFC-141b como agente espumante. El proyecto incluye costos adicionales de capital para cubrir dos máquinas de espumación de alta presión($EUA 160 000), la retroadaptación de cinco moldes ($EUA 10 000), tres máquinas para revestimiento interior de los moldes ($EUA 15 000) y un sistema de ventilación ($EUA 6 000). Otros costos incluyen los ensayos, puesta en marcha ($EUA 12 000) y capacitación ($EUA 7 000). La empresa solicita costos adicionales de explotación por $EUA 87 951 por un período de dos años, debido al costo superior de los productos químicos.

Espuma de poliestireno extruido

Proyecto general: nueve empresas

Información de antecedentes

7. Este es el tercero de una serie de proyectos generales preparados por la ONUDI para China en el sector de espumas de polietileno/poliestireno [EPE/EPS]. Dos proyectos generales en el subsector del polietileno fueron aprobados en la 28ª y 31ª reuniones y están en vías de ejecución. A petición del Comité Ejecutivo en la 28ª reunión, en julio de 1999, la ONUDI preparó un plan estratégico para el subsector, del que finalmente tomó

nota el Comité Ejecutivo en su 33ª reunión, en marzo de 2001. El plan estratégico preveía la eliminación del CFC-12 restante en el sector, con un costo total de $EUA 10,4 millones. El aspecto clave de la solicitud del Comité Ejecutivo fue que la ONUDI y China asegurasen que no se había identificado ninguna conversión de la considerable capacidad ociosa. De modo que el Comité había decidido que la estrategia debía asegurar que la capacidad total de las empresas para las cuales se solicitaría la conversión correspondería al nivel de producción existente del subsector indicado en la estrategia, incluyendo los proyectos ya aprobados.

8. En el plan estratégico se presentó el siguiente plan al Comité Ejecutivo.

Proyecto	Fecha de la presentación	Costo estimado en millones $EUA	Eliminación de toneladas PAO	Rentabilidad
EPE terminal para 30 fábricas con 61 líneas	Mediados de 2001	5,9	810	7,38
1er proyecto de grupo EPS para 12 empresas con 19 líneas	Fines de 2001	2,9	686	4,22
Proyectos generales terminales EPS para 8 empresas con 10 líneas	Mediados de 2002	1,6	332	4,77

9. El Gobierno de China ha decidido revisar el calendario y presentar el proyecto EPS a mediados de 2001 en vez del proyecto general terminal EPE. Por lo tanto, se somete el proyecto a la 34ª reunión.

10. El plan preveía la racionalización industrial, que habría reducido de 20 a 17 la cantidad de fábricas en el sector EPS y de 29 a 26 las líneas de extrusión para la conversión de 1 018 toneladas PAO de CFC-12 en total. En consecuencia, el primer proyecto general EPS permitiría una reducción de 12 a 10 en las fábricas y de 19 a 17 en la cantidad de líneas que se convertirían. Pero la ONUDI informó que se habían producido algunas fusiones entre las fábricas antes de preparar el proyecto. Como resultado, el primer proyecto general EPS abarcará 14 de las 20 empresas originales. La consolidación de algunas de las 14 empresas ha determinado que el proyecto abarque 9 empresas que convertirán 19 de las 21 líneas de extrusión, para eliminar 750 toneladas PAO.

11. Las nueve empresas incluidas en el proyecto general (Nanjing, Nanjing Yue'an, Hangzhou Kangda, Hangzhou Jinying, Guangdong Fushan, Guangdong Nanhai, Guangdong Dongguan, Cangzhou Yongxiang y Guangdong Dongguan Yosheng) consumieron en total 754 toneladas PAO de CFC-12 por año en la producción de espuma de poliestireno extruido (promedio entre 1998 y 2000). Las empresas utilizan extrusoras de una capacidad de 50 kg/hora.

12. Las empresas convertirán su producción del CFC-12 al butano como agente espumante. El proyecto incluye costos adicionales de capital para las nueve empresas, por un monto de $EUA 4 931 100, comprendido el costo de readaptar 19 líneas de extrusión existentes, instalaciones de almacenamiento de butano y equipo de protección y seguridad contra incendios. Otros costos incluyen consultorías, ensayos y capacitación. Se deducen de los respectivos presupuestos economías adicionales de explotación por un

total de $EUA 584 846, según el nivel de consumo de CFC-12. El costo unitario de la conversión es de $EUA 266 150 por línea de extrusión, y la rentabilidad del proyecto es de $EUA 6,76/kg.

Espuma rígida

Proyecto general: 26 empresas

13. Este proyecto general para eliminar CFC-11 en 26 empresas de espuma pulverizada rígida de poliuretano fue presentado originariamente a la 32ª reunión. La descripción del proyecto figura en el documento UNEP/OzL.Pro/ExCom/32/30/China y Corr.1, que está a disposición de quienes lo soliciten.

14. El Comité Ejecutivo aprobó sólo el costo adicional de capital del proyecto, que asciende a $EUA 2 996 000, más 10% de gastos imprevistos, $EUA 299 600. No se aprobó el costo adicional de explotación de $EUA 5 751 140, que la ONUDI revisó más tarde a $EUA 4 979 568. Se pidió a la ONUDI que volviese a presentar el costo adicional de explotación, para estudiarlo después de proceder a una encuesta sobre los precios en el sector de espumas.

15. La ONUDI llevó a cabo una encuesta basada en las atribuciones convenidas con la Secretaría. El informe de la encuesta ha sido presentado a la Secretaría.

16. A base de este informe, la ONUDI solicita la aprobación de la cantidad de $EUA 5 361 113 como costo adicional de explotación del proyecto. El costo del proyecto, en función de ese monto, será el siguiente:

Costo adicional de capital:	$EUA 2 996 000
10% gastos imprevistos	$EUA 299 600
Costo adicional de explotación	$EUA 5 361 113
Costo total del proyecto	$EUA 8 656 713

Impacto del proyecto	891,40 toneladas PAO
Rentabilidad	$EUA 7,71/kg

COMENTARIOS Y RECOMENDACIONES DE LA SECRETARÍA

COMENTARIOS

Espuma rígida

Proyecto general: 26 empresas

17. Todavía se está examinando el informe sobre los precios, en el entendimiento de que el resultado incidirá sobre el costo de los proyectos presentados por la ONUDI y el Banco Mundial para el sector de espumas en China. El resultado del examen y las deliberaciones sobre el informe con los organismos de ejecución, así como el costo

adicional de explotación resultante del proyecto, se comunicarán al Subcomité de examen de proyectos.

Subsectores múltiples

Proyecto general (ONUDI)

18. Se ha convenido en el costo adicional de capital del proyecto. Pero el acuerdo sobre el nivel del costo adicional de explotación depende del acuerdo sobre los precios de los productos químicos, que todavía está en discusión. La donación admisible del proyecto se comunicará al Comité de examen de proyectos cuando se haya acordado el costo adicional de explotación.

Espuma de poliestireno extruida: Proyecto general: 9 empresas

19. En el examen del proyecto, la Secretaría reconoció varias cuestiones:

a) Aunque se había elaborado un "plan estratégico" para orientar la preparación de proyectos en el sector, los principales componentes del primer proyecto general EPS no son coherentes con los suministrados en el plan estratégico.

b) El costo de convertir las 19 líneas de extrusión, de alrededor de $EUA 5,1 millones, es considerablemente superior al monto estimado en el plan, de $EUA 2,9 millones.

20. A continuación, se presenta un resumen de los costos solicitados en el proyecto, comparados con los propuestos en el plan estratégico.

Partida	**Propuesto en el plan $EUA**	**Solicitado en el proyecto $EUA**
Costo de conversión de 19 líneas de extrusión	2,9 millones	5,1 millones
Costo unitario de la readaptación de extrusoras y otras instalaciones conexas	235 000	266 150
Economías adicionales de explotación por kg de CFC-12 eliminado	1,6	0,78
Rentabilidad por kg de CFC-12 eliminado	4,22	6,76

21. En el examen se identificaron ciertas partidas de costos adicionales de capital y de explotación que no eran coherentes con proyectos semejantes aprobados en China o en otros países que operan al amparo del Artículo 5.

22. El proyecto todavía está en discusión entre la Secretaría y la ONUDI. El resultado de las deliberaciones se comunicará al Subcomité de examen de proyectos.

Medidas sobre las secciones pertinentes de la Decisión 33/2

Compromisos del Gobierno y las empresas

23. La Secretaría recibió del Gobierno de China cartas de envío de los proyectos generales (poliestireno/polietileno), en las cuales se manifestaba, entre otras cosas, en coincidencia con la Decisión 33/2 c) del Comité Ejecutivo, que:

a) La dependencia nacional del ozono ha validado el consumo total de CFC-11 como 941,6 toneladas PAO que eliminarán las empresas comprendidas en los proyectos generales.

b) Se ha advertido al Gobierno de China que su acuerdo con el proyecto indica un compromiso para asegurar que se cumplió con la cifra de eliminación validada de 941,6 toneladas PAO y que había resultado una reducción sostenida del consumo en su sector espumas en 2000.

24. La Secretaría también recibió notas de compromiso firmadas de los gerentes de empresas individuales, en las cuales se afirmaba, entre otras cosas, su compromiso de eliminar por completo el CFC-11 y no recaer en su empleo después de la conversión, de colaborar con el organismo de ejecución para devolver todos los fondos para gastos imprevistos no utilizados y los fondos que supuestamente tendrían que haberse usado en situaciones de graves irregularidades identificadas, así como otros compromisos estipulados en virtud de la Decisión 33/22 y otras normas pertinentes que rigen la aprobación de proyectos.

25. Los documentos citados se encuentran en la Secretaría, a la disposición de quienes los soliciten.

RECOMENDACIONES

Pendiente.

HOJA DE EVALUACIÓN DE PROYECTO
CHINA

SECTOR: Refrigeración Uso de SAO en el sector (1999): 6 300 toneladas PAO

Umbrales de rentabilidad del subsector: Doméstica $EUA 13,76/kg

Título del proyecto:

(a) Sustitución del agente espumante CFC-11 por ciclopentano y del CFC-12 como refrigerante por HFC-134a en la fabricación de refrigeradores domésticos en Shangling Electric Appliance (Group) Co. Ltd.

Datos del proyecto	**Doméstica**
	Shangling
Consumo de la empresa (toneladas PAO)	490,50
Impacto del proyecto (toneladas PAO)	490,50
Duración del proyecto (meses)	36
Monto inicial solicitado ($EUA)	3 290 638
Costo final del proyecto ($EUA):	
Costo adicional de capital (a)	3 442 500
Gastos imprevistos (b)	344 250
Costo adicional de explotación (c)	450 619
Costo total del proyecto (a+b+c)	4 237 369
Propiedad local (%)	97%
Componente de exportación (%)	2%
Monto solicitado ($EUA)	
Rentabilidad ($EUA/kg.)	6,21
¿Financiación de contraparte confirmada?	
Organismo nacional de ejecución	SEPA
Organismo de ejecución	BIRF

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

DESCRIPCIÓN DEL PROYECTO

Antecedentes del sector

- Último consumo total de SAO disponible (1999)	67 580,00 toneladas PAO
- Consumo inicial de sustancias del Grupo I del Anexo A (CFC)	57 818,00 toneladas PAO
- Consumo de sustancias del Grupo I del Anexo A en el año 1999	42 983,00 toneladas PAO
- Consumo inicial de CFC en el sector de la refrigeración	No disponible
- Consumo de CFC en el sector de la refrigeración doméstica en 1999, incluso servicio técnico	6 300,00 toneladas PAO
- Fondos aprobados para proyectos de inversión en el sector de la refrigeración hasta diciembre de 2000 (32ª reunión)	$EUA150 893 871
- Cantidad de CFC que se eliminarán en proyectos de inversión en el sector de la refrigeración hasta fines de 2000	11 313,00 toneladas PAO

26. Según información aportada por el Gobierno de China, sólo queda por financiar por el Fondo Multilateral un proyecto de inversión en el sector de la refrigeración doméstica. Las empresas restantes en el sector son todas pequeñas y medianas. Se preparará un proyecto general terminal, que se presentará más adelante.

27. El Comité Ejecutivo ha aprobado $EUA 150,9 millones para proyectos de eliminación de 11 313 toneladas PAO de CFC en el sector de la refrigeración doméstica en China.

28. El proyecto Shangling fue presentado a la consideración del Comité Ejecutivo en la 33ª reunión. El Comité Ejecutivo decidió aplazar la consideración del proyecto citado, a la espera de una consulta entre el Banco Mundial y la empresa en cuestión (Decisión 33/45). A continuación se reproducen la descripción del proyecto y los comentarios de la Secretaría, incluso la evolución de los acontecimientos después de la 33ª reunión.

Shanghai Shangling Electric Appliance

29. Esta empresa, de propiedad nacional en un 96,52 %, consumió 409,3 toneladas PAO de CFC-11 y 81,2 toneladas PAO de CFC-12 en la fabricación de 394 976 unidades de refrigeradores domésticos en 1999. Cuenta con cinco líneas: tres líneas de producción de refrigeradores, una línea de producción de congeladores (ociosa en los dos últimos años) y una línea de servicio técnico para refrigeración. El equipo existente de producción de espumas consiste en 18 surtidores de espuma de alta presión, que alimentan guías y artefactos de espumación instalados en las líneas de producción de gabinetes y puertas. La empresa está dotada también con equipo de montaje, evacuación y carga de refrigerante.

30. El proyecto propuesto eliminará 490,5 toneladas PAO de CFC-11, convirtiendo al ciclopentano en las operaciones de espumación (en las líneas 1, 2 y 3) y al HFC-134a en la parte de refrigerantes (en las líneas de montaje 2, 3 y la línea de servicio técnico). La

línea de montaje 1 ha sido convertida al HFC-134a en virtud de un proyecto previamente aprobado por el Comité Ejecutivo. Shangling desmantelará la línea 4 (producción de congeladores) a su propia costa después de completar este proyecto, para lograr la eliminación completa de SAO en todas sus líneas de producción.

31. La adopción de un nuevo agente espumante inflamable requiere una modificación sustancial del proceso de producción existente, para asegurar condiciones de trabajo seguras. En la propuesta se solicitan fondos para modificar/sustituir 18 máquinas de alta presión existentes, la sustitución de estaciones de premezclado, la modificación eléctrica de las guías y artefactos de espumación existentes y la instalación de sistemas de detección de gases, ventilación y aprovisionamiento de nitrógeno. El costo solicitado para la conversión de la parte de espumación asciende a $EUA 2 982 500. La conversión a la tecnología con HFC-134a requiere cambiar las máquinas de carga de refrigerante, los detectores de pérdidas y el reemplazo/retroadaptación de las bombas de vacío, con un costo de $EUA 709 770. Otros costos incluyen la transferencia de tecnología, ensayos, capacitación y certificación de seguridad. Los gastos imprevistos se calculan en el 10%.

32. Se solicitan costos adicionales de explotación por el monto de $EUA 450 619, durante un período de sesis meses, que refleja el costo superior de los productos químicos y un aumento en la densidad de la espuma.

COMENTARIOS Y RECOMENDACIONES DE LA SECRETARÍA

COMENTARIOS

33. El Comité Ejecutivo ya ha aprobado dos proyectos de inversión ejecutados por el Banco Mundial para la empresa citada:

- La conversión a una espuma de CFC reducida en un 50 % en la fabricación de refrigeradores, con un costo de $EUA 958 000 (aprobado en la 10ª reunión), y
- Asistencia de ingeniería para la conversión de la fabricación de refrigeradores al HFC-134a, con compresor rotativo en la fábrica general de refrigeradores Shangling de Shanghai, con un costo de $EUA 1 327 000 (aprobado en la 13ª reunión).

34. Estos dos proyectos abarcaban la conversión de toda la producción de la empresa en aquella fecha. Ambos proyectos han sido completados.

35. La Secretaría solicitó al Banco Mundial que aclarase la fecha de instalación de las cuatro líneas adicionales de producción enumeradas en la propuesta actual. El Banco informó que en el período 1993-1994, a la vez que avanzaba en los dos proyectos anteriores, la empresa había inaugurado simultáneamente nuevas instalaciones de producción basadas en CFC. Los proyectos aprobados sólo cubrían la conversión de una línea de producción. La nueva capacidad de producción fue instalada después de la fecha de aprobación, pero antes de julio de 1995.

36. La Secretaría objetó la fiabilidad de los datos de producción y consumo de CFC diferentes de los suministrados en el informe de terminación de proyecto relativo a la conversión a HFC-134a, mencionada en el proyecto que figura en el segundo punto del párrafo 33 anterior. El Banco Mundial verificó los datos de producción y consumo en 1999 mediante la visita de un consultor a la empresa e informó que la empresa había producido 394 976 unidades, como se informaba en el documento de proyecto. En la tabla siguiente se desglosa la producción y la capacidad en las tres líneas de producción:

	Producción	**Capacidad**
Línea 1	2 076	420 000
Línea 2	362 800	400 000
Línea 3	30 100	200 000
Total	394 976	1 020 000

37. Dada la importante subutilización de la capacidad instalada y la semejanza de los modelos producidos en las tres líneas, la Secretaría propuso al Banco que estudiara la racionalización de la producción en Shangling, consolidando todas las instalaciones de fabricación en la línea 2. El Banco Mundial desechó la propuesta, señalando que debía mantenerse la capacidad existente.

38. Citando otros proyectos en China y en otros países, en los cuales el Comité Ejecutivo ha tenido en cuenta la utilización de la capacidad al calcular el costo adicional, la Secretaría propuso entonces calcular los costos adicionales de capital a base de la retroadaptación de un número reducido de máquinas de espumación en la línea 1 y la línea 3. Así se reflejarían los muy bajos índices de utilización del equipo de espumación, que son del 0,5 % y del 15 %, respectivamente. En consecuencia, el nivel de la donación se calculó en la suma de $EUA 2 370 702, incluyendo los costos adicionales de explotación. La Secretaría adelantó esta cifra para que la considere el Subcomité de examen de proyectos y le explicó al Subcomité la base de cálculo, tomando en cuenta el índice de utilización de capacidad. Tras un debate, el Comité invitó al Banco Mundial a que comunicase las cifras propuestas a la empresa. Posteriormente, el Comité Ejecutivo aplazó el proyecto, porque el Banco Mundial no pudo indicar que la empresa hubiera dado su conformidad.

39. La SEPA ha suministrado recientemente a la Secretaría información actualizada sobre los niveles de producción en Shangling en 1999 y 2000, notificados por la empresa a la Asociación china de refrigeración. La producción en 1999 fue de 234 976 unidades y de 189 505 unidades en 2000. En el año 2000 no hubo producción en la línea 1, la línea 3 produjo solamente 7 286 unidades y las 182 219 unidades restantes fueron producidas en la línea 2.

40. La información actualizada sobre la producción en 1999 es muy inferior a la cifra empleada para calcular los costos adicionales que se presentó a la 33ª reunión. La Secretaría ha tratado de aclarar con el Banco Mundial la discrepancia en las cifras de producción de 1999. El Banco Mundial sugirió que deberían usarse las cifras de producción del año 2000 para calcular los costos adicionales de explotación del proyecto. La Secretaría convino en que se usaran las cifras de producción de 2000, pero señaló que esas nuevas cifras reducen aun más el índice de utilización de la capacidad de producción

de la empresa. La Secretaría considera que también será necesario reflejar este reducido índice de utilización al determinar los costos adicionales de explotación y está colaborando con el Banco Mundial para precisar el nivel de financiación admisible.

41. Se informará en consecuencia al Subcomité de examen de proyectos sobre el resultado de esta actividad.

HOJA DE EVALUACIÓN DE PROYECTO
CHINA

SECTOR: Espumas Uso de SAO en el sector (1999): 19 162 toneladas PAO

Umbrales de rentabilidad del subsector: n/a

Título del proyecto:

a) Plan sectorial para eliminar el CFC-11 en el sector de espumas en China

Datos del proyecto	**Subsectores múltiples**
	Plan sectorial PU
Consumo de la empresa (toneladas PAO)	19 162,00
Impacto del proyecto (toneladas PAO)	12 071,00
Duración del proyecto (meses)	108
Monto inicial solicitado ($EUA)	14 300 000
Costo final del proyecto ($EUA):*	92 200 000
Costo adicional de capital (a)	76 027 400
Gastos imprevistos (b)	
Costo adicional de explotación (c)	13 935 959
Costo total del proyecto (a+b+c)	115 300 000
Propiedad local (%)	100%
Componente de exportación (%)	0%
Monto solicitado ($EUA)	
Rentabilidad ($EUA/kg.)	
¿Financiación de contraparte confirmada?	
Organismo nacional de ejecución	SEPA
Organismo de ejecución	BIRF

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

* (a+b+c) no coincide con el costo total del proyecto porque el costo total del proyecto se calculó sobre una base diferente. El costo total del proyecto no incluye el costo de la asistencia técnica, estimado en $EUA3,5 millones.

PLAN SECTORIAL SOBRE ESPUMA DE POLIURETANO (PU) EN CHINA Y PRIMER PROGRAMA DE EJECUCIÓN

Nota de la Secretaría

1. El Banco Mundial ha presentado un plan sectorial para la eliminación del consumo de CFC-11 en el sector de las espumas de poliuretano en China. También ha presentado un "Primer programa de ejecución" solicitando su aprobación por un monto total de $EUA 15,1 millones. De esa cifra, $EUA 14,3 millones se solicitan para financiar "contratos de reducción de CFC-11", mientras que $EUA 800 000 se aplicarán a asistencia técnica.

Información de antecedentes

2. Este es el segundo plan nacional para el sector de espumas preparado por el Gobierno de China. El primer plan para el sector de espumas en China fue preparado bajo la guía de la NEPA (actualmente SEPA) y el Consejo nacional de la industria liviana de China (CNCLI) por la Asociación de la industria de procesamiento de plásticos de China, con el apoyo del PNUD y el Banco Mundial. El plan sectorial fue preparado en 1995 a base de un análisis detallado de la situación en esa época, así como de las futuras tendencias en la industria de las espumas y fue considerado como un "plan de acción efectivo para la eliminación de SAO en la industria de las espumas en China". Puede solicitarse en la Secretaría una copia del plan sectorial, titulado "Estrategia para las espumas SAO".

3. El plan sectorial proporcionaba información hasta 1994 sobre los productores de productos de espuma, incluso su cantidad, sus nombres, su consumo de CFC actual y proyectado, escenarios de eliminación y costos. En el plan sectorial se identificaban en 1994 un total de 186 empresas, de las cuales 61 producían espuma flexible (excepto para cajas), 38 espuma para cajas flexible, 40 espuma semirrígida y 47 espuma rígida. También ofrecía una estrategia de ejecución para la eliminación de CFC basada sobre todo en proyectos de demostración seguidos de proyectos de inversión que se presentarían en lotes. Algunos de los proyectos de demostración y de inversión propuestos en el plan sectorial ya han sido aprobados y ejecutados. Hasta fines de 2000, el Comité Ejecutivo había aprobado 114 proyectos de inversión en el sector de las espumas de poliuretano para China, con una financiación total de $EUA 57,8 millones para eliminar 9 887,2 toneladas PAO.

El plan para el sector de poliuretanos

4. El Comité Ejecutivo aprobó $EUA 300 000 para el Banco Mundial en la 30ª reunión, destinados a preparar el plan sectorial para eliminar los CFC en el sector de las espumas de poliuretano en China. El documento fue preparado en colaboración con un grupo de trabajo especial sobre espumas, constituido por el Gobierno de China.

5. Los costos asociados de los planes sectoriales se calculan a base del consumo del sector espumas en 1999 de 19 162 toneladas, establecido en la actualización del

programa de país de China. El objetivo del plan consiste, pues, en lograr la eliminación completa de ese consumo básico (19 162 toneladas) antes de 2009.

6. En la tabla siguiente se brinda información sobre la situación del sector de las espumas de pioliuretano en las épocas del primer (1995) y segundo (2000) planes sectoriales.

	Plan sectorial de 1995	**Plan sectorial de 2000**	**Proyectos ya financiados hasta 2000**
Cantidad total de empresas de espumas	186	1,115	141*
Consumo total estimado (toneladas PAO)	15 699	12 510	14 988,9
Cantidad de empresas de espuma rígida y semirrígida (incluso revestimiento integral y espuma moldeada flexible)	87	190	70*
Consumo de SAO (toneladas PAO)	10 899	5 160	6 084
Cantidad de empresas de embaldosado flexible	61	125	36*
Consumo de SAO (toneladas PAO)	Aprox. 4 420	6 122	3 412,5
Empresas de espuma para cajas flexible	38	100	3*
Consumo de SAO (toneladas PAO)	Aprox. 380	102	288,7

* Las cifras se refieren a la cantidad de proyectos aprobados, algunos de los cuales comprendían más de una empresa.

7. El plan sectorial consta de ocho secciones y un resumen ejecutivo. En las primeras dos secciones se describen los antecedentes del sector de espumas en China y su desempeño hasta la fecha. En la Sección II, el documento presenta los antecedentes y resultados de la encuesta que se realizó y usó como base para elaborar el plan. En la encuesta se identificaron 408 (37%) de las 1 115 empresas productoras de espuma de poliuretano que se calcula que existen. Las opciones tecnológicas y las estrategias que se deberían adoptar y sus costos estimados se describen en las secciones sobre "Estrategia de eliminación" y "Análisis de costos adicionales" (secciones IV y VI, respectivamente). Usando el concepto de "índices de admisibilidad" y otras aproximaciones, el cálculo del costo de eliminación, que se basa primodialmente en el método de cálculo de los proyectos individuales, da por resultado un monto de $EUA 89,96 millones. Además, se solicitan $EUA 3,5 millones en el rubro de aspectos de política para programas de asistencia técnica. En el capítulo sobre "Mecanismos de funcionamiento" se prevén las modalidades de ejecución del plan.

Primer programa de ejecución

8. Junto con el plan sectorial se presentó un "Primer programa de ejecución" que abarca el período 1 de julio de 2001 – 31 de diciembre de 2002. El Banco Mundial solicita un monto de $EUA 14,3 millones que se usarán para financiar contratos de reducción de CFC-11 para 50-80 empresas, con el fin de eliminar 2 000 toneladas de CFC-11 antes de fines de 2004 y 2005. Esos 50-80 proyectos incluyen dos grupos de 19 empresas de espuma de embaldosado flexible en las provincias de Chengdu y Henan, para los cuales se presentaron a la 32ª reunión dos proyectos generales por un total de

unos $EUA 9,0 millones. Además, se solicitan $EUA 800 000 para actividades de asistencia técnica, con una demanda de $EUA 15,1 millones en total.

COMENTARIOS Y RECOMENDACIONES

Plan para el sector de espumas de poliuretano (PU) en China (Banco Mundial)

9. Desde que se constituyó el Fondo, se han aprobado $EUA 80 358 917 para 164 proyectos de eliminación de 14 989 toneladas de CFC-11 en el sector de las espumas en China, con una rentabilidad media de $EUA 5,36 por kilogramo. En el subsector de la espuma de poliuretano, se han aprobado 114 proyectos (excluyendo los proyectos ajenos a la inversión) por $EUA 57 839 086 para eliminar 9 887,2 toneladas PAO, con una rentabilidad media de $EUA 5,85/kg. Junto a estos antecedentes, el Gobierno de China solicita $EUA 92 200 000 para completar la eliminación.

10. El plan sectorial es de forma muy semejante al plan aprobado para el sector de los solventes, y anteriormente, para el sector de los halones. Se utiliza una metodología similar para proponer el nivel de consumo, establecer el perfil del subsector, determinar la admisibilidad de las empresas y el consumo antes de 1995, analizar los costos de los proyectos aprobados y extender los costos aprobados para cubrir el consumo admisible restante.

11. Las modalidades de ejecución también son muy semejantes, con contratos de eliminación de SAO que se otorgarán mediante un sistema de licitación a las empresas más grandes y un sistema de vales que se usarán para suministrar equipo y asistencia técnica a las PyMEs. Pero la posibilidad de aplicar esta modalidad al sector de espumas es un asunto que requiere consideración más atenta, dadas las características únicas y la especificidad de las tecnologías de conversión. Se proponen medidas normativas para limitar el abastecimiento, con el fin de cumplir con los niveles máximos de consumo acordados.

12. Se propone aprobar la financiación en dos cuotas anuales, en función del desempeño comprobado para cumplir con las metas anuales previamente acordadas. Se propone que la SEPA dirija el proyecto, en el que la ejecución correría por cuenta de un organismo nacional y la supervisión estaría a cargo del Banco Mundial.

<u>Consumo y determinación de los costos</u>

13. Plantea importantes problemas determinar la admisibilidad de la capacidad de producción de las empresas para financiarlas a base de la Decisión 17/7 sobre capacidad instalada con SAO después del 25 de julio de 1995, dado el crecimiento industrial en los últimos años y la información disponible, tanto en el documento del Banco Mundial como en los documentos de estrategia del sector para 1995. También requiere cuidadoso análisis la pretendida cifra del 85 % como “índice de admisibilidad”.

14. Es necesario prestar más atención a la base para establecer los costos unitarios, comprendidos los precios de los productos químicos, los precios de los equipos y la metodología. Cabría esperar que la rentabilidad ponderada del plan sectorial (ahora de $EUA 6,96/kg) debería ser tan buena o mejor que el nivel ponderado general dimanante de los proyectos aprobados hasta la fecha ($EUA 4,22/kg).

Medición, notificación, supervisión y auditoría del desempeño

15. Es necesario asegurarse de que quede tiempo suficiente para registrar y verificar el desempeño antes de solicitar la aprobación de la próxima cuota. La exposición sobre este aspecto del plan es muy superficial (párrs. 7:18, 7:19). Se requiere una atención más detallada sobre estos procesos.

Primer programa de ejecución

16. En el primer programa de ejecución no se describen los proyectos que se financiarán y se desglosan los costos de la asistencia técnica. Con respecto a los costos de la asistencia técnica, es necesario revisar su admisibilidad, ya que los costos de los proyectos en el plan sectorial sobre espumas de poliuretano se han calculado incluyendo los costos de transferencia de tecnología y capacitación y ya han sido aprobados para el sector varios proyectos de asistencia técnica y de demostración.

Proyectos generales de Chengdu y Henan

17. En la 32ª reunión, el Banco Mundial presentó dos proyectos grupales en el sector de espumas en China. El Comité Ejecutivo decidió aplazar la aprobación de los proyectos a la espera de la preparación de una estrategia de eliminación sectorial para el sector de las espumas en China, que estaba previsto que se presentaría en la segunda reunión del Comité Ejecutivo en 2001. Sobre esta base, los proyectos se mantendrían en el plan administrativo del Banco Mundial para 2000 (Decisión 32/52).

18. Los dos proyectos de un valor combinado de $EUA 8 956 330 se incluyen ahora en la estrategia sectorial como un componente del primer plan de ejecución, sin especificar costo alguno. Es decir, que aunque financiados como parte de la estrategia, seguirán siendo ejecutados como dos proyectos grupales autónomos. En la 32ª reunión, la Secretaría presentó una reseña de los proyectos en la que señalaba que el Banco no había contestado a los diversos comentarios de la Secretaría acerca de la consolidación industrial, la admisibilidad de las empresas y cuestiones de costos, y que los proyectos no contaban con una recomendación de aprobación.

19. No se había recibido ninguna información adicional del Banco Mundial con respecto a estos dos proyectos y las cuestiones que planteaba la Secretaría siguen sin respuesta. No obstante, el Banco informó a la Secretaría que solicitaría la aprobación de los dos proyectos en la reunión en curso. La Secretaría no está en condiciones aún de recomendar la aprobación y advierte que, a menos que el Comité Ejecutivo se incline por aprobar el primer plan de ejecución de la estrategia sectorial en esta reunión, lo cual

tampoco puede recomendar la Secretaría, no existe actualmente ningún mecanismo para considerar separadamente los dos proyectos.

20. Cuando se consideren los proyectos generales para Chengdu and Henan, el resto del primer plan de ejecución consistiría en una solicitud de $EUA 6,1 millones para cubrir contratos de eliminación de 31-61 empresas todavía no especificadas.

PROJECT COVER SHEET

COUNTRY: China	**IMPLEMENTING AGENCY:** The World Bank
PROJECT TITLE:	SECTOR PLAN FOR PHASEOUT OF CFC-11 IN THE CHINA FOAM SECTOR
PROJECT IN CURRENT BUSINESS PLAN:	YES
SECTOR:	Foam
SUB-SECTORS COVERED:	PU Foam (Flexible, Rigid, Integral skin)
ODS USE IN SECTOR: (1999)	19,162 MT ODP
PROJECT IMPACT :	12,071 MT ODP
PROJECT DURATION:	9 years
PROJECT COSTS:	**US$115,300,000**
LOCAL OWNERSHIP: 100 %	**EXPORT COMPONENT:** 0
REQUESTED GRANT:	**US$ 92,200,000**
IA SUPPORT COSTS:	**T.B.D.**
TOTAL COST OF PROJECT TO MLF:	**T.B.D.**
COST EFFECTIVENESS (weighted average):	US$6.97/kg ODP
STATUS OF COUNTERPART FUNDING:	N/A
PROJECT MONITORING MILESTONES INCLUDED:	**YES X NO**
NATIONAL COORDINATING AGENCY:	State Environmental Protection Administration

PROJECT SUMMARY: With the completion of this sector plan, all CFC-11 consumption in the PU Foam sector in China will be eliminated. The funding request targets the remaining eligible consumption of 12,071 MT of CFC-11, and will be carried out through a series of annual programs, starting with a single implementation program for 2001 and 2002. In conjunction with presently ongoing foam projects and other projects also being prepared, including for the PS/PE Sector and the domestic refrigeration sector, this project will result in complete phaseout of CFC-11 use for foam applications in China by 2009. There are estimated to be more than 1,115 PU foam enterprises in China, and in addition to enterprises already funded by the MLF for conversion, detailed information has been collected for 408 more enterprises during preparation of the sector plan. The plan proposes to consolidate and replace present ODS-based technology with a combination of cyclopentane, HCFC-141b, LCD, variable pressure, methylene chloride and water blown technologies. Conversion projects will be accompanied by associated policy actions to ensure that the phaseout proceeds on schedule, and that ineligible enterprises not being financed under the project are also compelled to stop use of CFC-11. An action plan indicating annualized phaseout targets is included in the proposal.

Prepared by: Foam Sector Working Group, China, and the World Bank **Date:** May 17, 2001

Reviewed by: Mike Jeffs, OORG Reviewer **Date**: May 11, 2001

Sector Plan for Phaseout of CFC-11 Consumption in China Foam Sector

May 17, 2001

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EXECUTIVE SUMMARY

1. ***Background:*** China signed the Montreal Protocol in 1991 and established a country program for actions to phase out use of ODS. With the approval of the sector phaseout plan in March 1999 to phase out all production of CFCs, it has become necessary to address phase-out in the consumption sectors as a whole, to minimize the impact on the industrial development or growth of the affected sectors.
2. ***Project Objective:*** In conjunction with presently ongoing foam projects and other projects for the PS/PE sector and the domestic refrigeration sector developed by China with other implementing agencies, this project will result in complete phaseout of 19,162 MT of CFCs from the foam sector in China by the end of 2009. These actions will help China to meet its present and future obligations under the Montreal Protocol. This Sector Plan, which has been developed by China with the World Bank, specifically targets the PU foam sector in terms of data analysis, broad strategy for phaseout, the policy framework, operating mechanism and incremental cost. The current estimated eligible consumption of 10,651 MT of CFC in the sector in China will be phased out through a series of annual programs. Providing for an annual growth rate of 3% for this consumption, the targeted phaseout amount of CFC-11 over the plan period is estimated to be 12,071 MT. Other consumption will be phased out through policy option and control of CFC supply in China.
3. ***Scope and Content***: The plan proposes to consolidate and replace present ODS-based technology with a combination of alternative technologies, including pentane and HCFC-141b for the rigid sub-sector, LCD and variable pressure/methylene chloride technologies for flexible foam, and water-blown for integral skin sub-sectors. Conversion projects will be accompanied by associated policy actions to ensure that the phaseout proceeds on schedule, and that ineligible enterprises not being financed under the project are also compelled to stop use of CFC-11. An action plan indicating annualized phaseout targets is included.
4. ***Data:*** The foam sector has been surveyed through questionnaires and field visits, and the data contained in this proposal is derived from three rounds of surveys. There are estimated to be more than 1,115 PU foam enterprises consuming CFC 11 in China. In addition to enterprises already funded by the MLF for conversion, detailed information has been collected for about 408 enterprises during preparation of the sector plan. The survey data was used to establish consumption data, eligibility of enterprises for inclusion in the plan, and assumptions on costs and prices.
5. ***Costs calculations:*** An incremental costs analysis was used to calculate the estimated actual conversion costs to China based on MLF guidelines and the eligible funding based on ExCom thresholds. The project proposes funding based on the lower of those two calculations for each sub-sector. Based on the actual consumption of CFCs in the flexible foam, rigid foam and integral skin sub-sectors, a weighted average phaseout costs of

US$6.96 per kg of CFC phased out was derived, and used to determine the eligible funding for the sector as a whole. Using this approach, a funding request of US$ 92.2 million has been prepared. This includes incremental costs of $ 88.7 million, and a technical assistance request of $ 3.5 million. The annual phaseout targets and funding requested are summarized below.

6. ***Adjustment for HCFC-141b consumption:*** Where possible, cyclopentane technology was used in the conversion of the rigid foam sub-sector. However, the proposal also includes a replacement of CFC-11 with HCFC-141b in the remaining rigid applications. An adjustment has therefore been made for the residual ODP consumption that will result. It is estimated that the impact of HCFC-141b consumption will amount to 341 MT over the life of the project. The funding request has accordingly been adjusted by $ 2.4 million.

Annual Phaseout targets and funding requests

Assumptions			
Annual growth of consumption			3 %
Weighted average cost threshold ($.kg)			6.96
Annual Inflation rate			2.5%
Year of Program	**Remaining eligible consumption (MT)**	**Consumption to be phased out under program (M)**	**Calculated incremental cost (US$ million)**
1999	10,651	-	
2000	10,971	-	
2001	11,300	2000[1]	14.3
2002	9,579		
2003	7,806	2,000	14.6
2004	5,465	2,500	18.7
2005	3,054	2,500	19.2
2006	571	2,500	19.7
2007	-	571	4.6
2008	-	-	
2009	-	-	
2010	-	-	
TOTAL		12,071	91.1
Adjustment for HCFC-141b consumption		341	-2.4
Net incremental costs requested			88.7
Technical Assistance			3.5
TOTAL			**92.2**

7. ***Agency support costs:*** Agency support costs have not yet been included in the proposal, and are to be determined by the ExCom as per Decision 26/41.
8. ***OORG Review:*** The proposal has been reviewed and approved for submission by the Bank's OORG reviewer for the foam sector. His comments are attached at Annex II.

[1] The first program will address 2001 and 2002, to be followed thereafter by annual programs.

I. INTRODUCTION

A. BACKGROUND

1.1 China signed the Vienna Convention for the Protection of the Ozone Layer in September 1989, signed the Montreal Protocol in 1991, and ratified the London Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer (hereafter referred to as the Montreal Protocol or MP) in 1991. Since then, China has been committed to the phaseout of Ozone Depleting Substances (ODS) in accordance with its designation as an Article 5 country as classified under the Montreal Protocol. In January 1993, the Chinese Government (hereafter referred to as the Government) approved the China Country Program for phaseout of Ozone Depleting Substances (hereafter referred to as the Country Program or CP), and started to implement ODS phaseout activities in China with the support of the Multilateral Fund (MLF) of the Montreal Protocol. Since 1999, China ODS phaseout activities have reached a new stage. The CFC production sector phaseout plan was approved in March 1999. An update to the CP was approved by the State Council in November 1999, to provide guidance for future phaseout activities.

1.2 In 1992, the Government established a Leading Group for Ozone Layer Protection and a Project Management Office (PMO) to manage and organize phaseout activities. This Leading Group has the overall responsibility for all phaseout activities. The Leading Group has assigned the State Environmental Protection Administration (SEPA) with management of the ODS phaseout program in China. The PMO was established within SEPA with administrative responsibility to coordinate and organize phaseout programs/projects implemented through the four International Implementing Agencies.

1.3 In 1999, there were about 1,345 enterprises in the Polyurethane (PU) foam sector in China, including CFC-consuming and non-CFC PU foam enterprises. Production in the foam sector has increased continuously to meet the demand for foam products, resulting in increased CFC consumption in this sector. The total consumption of CFC-11 in the foam sector was 19,162 MT in 1999. By the end of 2000, the phaseout target of CFC-11 through approved projects in foam sector was 10,222 MT; out of this, 3,504 MT had already been phased out by the end of 1999. China has gained valuable experience in ODS phaseout activities from the implementation of individual and umbrella phaseout projects. However, as a result of the presence of a large number of enterprises in the foam sector and the continued growth in demand for foam products, CFC consumption has not declined as expected. Now, as CFC production has been regulated and other sectors such as solvents and tobacco have been brought under sector plans for phaseout of CFCs, it is essential that a sector plan for the foam sector be put in place as quickly as possible, so that China can address the final remaining large consumption sector.

1.4 Along with the progress in implementing ODS phaseout activities in the Halon, MAC,

Solvent, and Tobacco sectors, ODS phaseout in the Foam sector has become critical to the future of phaseout activities in China. This large consuming sector comprises a lot of small and medium sized enterprises all over China. This poses a major challenge because of safety concerns of some substitutes, funding constraints, and management of geographically dispersed small CFC users. The most efficient approach is to fund incremental conversion costs of ODS phaseout at the national level, and to select appropriate operating mechanisms to complete phaseout in the entire sector.

1.5 The PU foam Sector Plan aims at the complete phaseout of CFC-11. It will establish an efficient operating mechanism to promote phaseout activities, to reach out to small users, to promulgate and monitor producers, and to develop a reporting and auditing mechanism on phaseout activities and fund utilization. The phaseout action plan is provided in Chapter VII. According to the *Sector Plan for CFC Production Phaseout in China*, the production of CFC-11 will be reduced year after year and ceased by January 1, 2010. The schedule for consumption phaseout of CFC-11 needs to match the production phaseout of CFC-11.

1.6 The objectives of the Sector Plan are:

a) To meet the obligations of the Government under the Montreal Protocol by phasing out CFC production and consumption in a coordinated program, and to ensure phaseout of CFC-11 consumption at the sector level;
b) To implement a timely and cost-effective action plan, that can be completed and monitored with monitoring indicators at the sector level;
c) To improve efficiency in the use of MLF resources by reducing management and implementation costs on the sector level; and
d) To provide economic incentives and technical assistance to small enterprises, and promulgate policies to ensure success.

B. PREPARATION OF FOAM SECTOR PLAN

1.7 At the 30th Meeting of the ExCom, resources were approved for China to prepare, with the assistance of the World Bank (WB), a sector plan for phasing out CFC-11 consumption in the PU foam sector in China. Subsequently, the Government of China established a foam special working group for all preparation activities. The special working group comprises experts from Peking University and industrial associations. This group conducted a few rounds of survey in 1999 and 2000 on ODS consumption by PU foam enterprises , and participated in preparation of the foam sector phaseout plan.

1.8 The Foam Sector Plan has been developed on the basis of the Government's obligations under the Montreal Protocol, and China's Country Program update (1999), and taking into account the principles established in other sector plans approved by the ExCom and the guidelines in the foam sector. The Foam Sector Plan is consistent with the MLF principles and guidelines as well as related documents on incremental costs.

1.9 The main principles and guiding determinants of the Foam Sector Plan are:

a) The Government's obligations under the London Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer;
b) The principles addressed in the China Country Program (CP) on Phasing Out Ozone Depleting Substances completed in 1993, and the CP Update in December 1999;
c) The national strategy and planning for economic and social development;
d) The need to develop a foam sector development plan to ensure that the development of the foam sector itself must not be jeopardized by ODS phaseout;
e) The Government's commitment to comply with the agreed overall and annual phaseout targets, assuming that the MLF approves the Sector Plan, disburses funds according to the Annual Programs, and facilitates the transfer of alternative technologies required for ODS phaseout in PU foam sector; and
f) Phase out of ODS in the foam sector in a cost-effective way.

1.10 The contents of the proposal are:

1.11 The Foam Sector Plan deducts ODS phaseout amount and costs from the baseline for foam projects already approved by the ExCom to avoid double counting. Implementation of the PU foam Sector Plan will not affect implementation of projects already approved.

1.12 This Sector Plan only addresses PU foam sector in terms of data analysis, broad strategy for phaseout, policy framework, operation mechanism and incremental costs. The remaining CFC-12 consumption in the PE/PS foam sub-sector will be covered through a strategy/action plan being prepared by China with the assistance of UNIDO, and the phaseout of remaining CFC-11 consumption in the household refrigeration foam sub-sector will be covered under a terminal umbrella project also being prepared by China with UNIDO assistance.

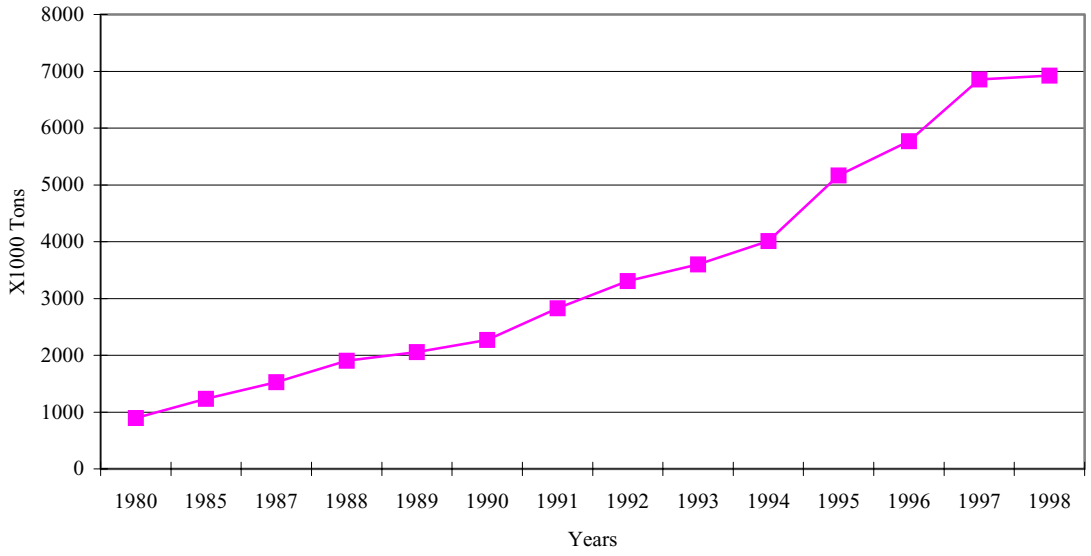
1.13 According to the working program of the foam special working group, one PU umbrella project (237 MT of CFC-11) with the assistance of UNIDO will be proposed for consideration to the 34th ExCom meeting. The phaseout amount in the project will be deducted from the scope of the PU Foam Sector Plan, to arrive at the net amount of CFC-11 to be phased out directly under the Sector Plan.

II. THE FOAM SECTOR IN CHINA

A. SECTOR BACKGROUND

2.1 The foam sector has developed rapidly over the past 20 years in China. Based on the China Statistics Yearbook of 1999, the production of foam and plastics in 1998 had multiplied 7 times since 1980. The historic production of foam and plastic is shown below[2].

Figure 2.1 Production of Foam and Plastics



2.2 The total number of CFC-11 consuming PU foam enterprises was about 1,115 and there were about 200 PS/PE enterprises in 1999 . Their products include furniture, domestic electricity products, packing materials, dishware, piping, cold storage, refrigeration equipment, and insulation materials. With rapid economic growth and development of the marketing system, the growth in foam production is estimated to have increased more than 10% per year over the past 20 years. In the early 1980s, most foam enterprises were large and state-owned; whereas, by late 1990s and into 2001, the sector population is mainly private, or collective enterprises of small and medium size. The production technology is relatively primitive, capacity utilization is low, and management capability is also relatively limited. The estimated number of foam producers in 1999, and their consumption of CFCs, are shown in Table 2.1.

[2] The production of foam and plastic is not separately available in the statistics.

Table 2.1 CFC Consumption and Foam Production in the Foam Sector in 1999

Classification	Main Products	Number of Enterprises	ODS	Consumption of CFCs (MT)	Estimated Foam Production (MT)
Continuous foam	Furniture	~300	CFC-11	~7,500	~170,000
Box foam	Furniture	~250	CFC-11	~1,400	~ 30,000
PU Rigid foam	Insulation materials, boards, pipes and Auto parts[1], furniture	~550	CFC-11	~10,000	~80,000
Integral skin		~15	CFC-11	~100	~ 3,000
Subtotal		**~1,115**		~19,000	~283,000
Refrigeration Foam	Insulation foam, cold storage	~30	CFC-11	4,800	~40,000
Extruded Polystyrene/PS/PE	Dishware, packaging tuck net	~200	CFC-12	4,000	~40,000
Subtotal		**~ 230**		8,800	~80,000
Total		**~1,345**		~27,800	~363,000

[1]/ These include integral skin for steering wheels, dashboards, stick shifts, handles, arm rests, and other parts inside automobiles.

2.3 The foam sector is comprised of the following applications:

a) PU foam -- All Polyurethane (PU) flexible foam applications, including integral skin; and all PU rigid foam applications, including transport foam applications;
b) PE/PS -- All PE/PS foam applications; and
c) Refrigeration foam -- All foam applications in the refrigeration industry.

2.4 Table 2.2 below shows the CFC consuming enterprises by sub-sector.

Table 2.2: Number of PU foam enterprises and CFC consuming enterprises

	Flexible foam	Rigid foam	Integral skin	Total
Total enterprises in the PU foam sector	~600-700	~650	~100	~1,345
Total CFC consuming enterprises in PU foam sector	~550	~550	~ 15	~1,115
MLF funded PU foam enterprises[1]/	41	113 [2]/	13 [3]/	167
Proposed UNIDO 2001 umbrella project		8		8
CFC consuming enterprises covered by the survey	225	179	4	408
Eligible enterprises identified by the survey	200	152	4	356
Non-eligible enterprises as identified by the survey [4]/	25	27	0	52

[1]/ Total number of projects financed by MLF is 112 and total number of enterprises included is 167 because of umbrella projects. See footnotes 2 and 3.

[2]/ The 113 enterprises are covered by 61 MLF projects. There are two umbrella projects, one with 26 enterprises and one with 31 enterprises.

[3]) The 13 enterprises are covered by 10 MLF projects, with one umbrella project with 4 enterprises.

[4]/ Enterprises covered by the survey are called "Identified enterprises" in the PU foam sector plan.

2.5 This foam sector plan includes CFC-11 phaseout for enterprises which use CFC-11 as foaming agent, including PU flexible foam, integral skin foam and PU rigid foam applications. Hereafter the term "foam sector plan" refers to the PU foam sector plan.

2.6 In 1999, the PU foam sector accounted for about 75% (19,162 MT) of the country's total CFC consumption. With the implementation of the halon sector plan, tobacco sector plan and solvent sector plan, the PU foam sector becomes the key remaining sector for CFC consumption phaseout, and adoption of the foam sector strategy is the one effective way to control CFC consumption at the national level. Proper monitoring of CFC phaseout and consumption will be very important in the next few years.

B. CFC CONSUMPTION IN CHINA

2.7 According to the Country Program Update of 1999, China's CFC-11 consumption was 25,605 MT, and there were three remaining sectors which consumed CFC-11 in 1999. These were the tobacco sector, the refrigeration sector (foaming agent and refrigerant) and the foam sector. CFC-11 consumption for PU foam was 19,162 MT, which included CFC-11 consumption by both ongoing MLF projects and the remaining eligible and ineligible enterprises. The historic consumption of CFC-11 in China is shown in Table 2.3. In spite of many foam projects being funded by the MLF between 1996 to 1999, CFC 11 consumption still grew at 7% during the same period.

Table 2.3 CFC-11 Consumption (in MT)

CFC- 11 consumption	1996	1997	1998	1999	Percentage(%)
PU foam sector	12,457	17,192	20,155	19,162	75
PU Refrigeration insulation foam	6,670	5,910	5,200	4,800	19
Tobacco sector	966	1,090	1,003	1,037	4
Industrial and commercial refrigeration sector	730	706	650	606	2
Total national CFC-11 consumption	20,823	24,898	27,008 1/	25,605 2/	100

1/ CFC production quota was introduced in 1999, thereby controlling CFC production

2/ Based on the CP Update which was reported to the 33rd ExCom meeting, CFC-11 production in 1999 was 22,681 MT adjusted with 1,000 MT from the stockpile of the CFC producers and 1,924 MT of net import.

2.8 CFC-12 was consumed by the foam, refrigeration, and aerosol sectors. The consumption of CFC-12 in 1999 for PS/PE was 3,981 MT by ongoing projects and remaining eligible and ineligible enterprises. Historic data of CFC-12 consumption is shown in Table 2.4 below.

Table 2.4: CFC-12 Consumption (in MT)

CFC-12 Consumption	1996	1997	1998	1999
National consumption	22,869	22,238	23,715	16,462
Foam sector (extruded polystyrene foam, PS sheet, PE tubes and sticks)	6,000	6,661	6,663	3,981
Refrigeration sector and aerosol sector	16,869	15,577	17,052	12,481

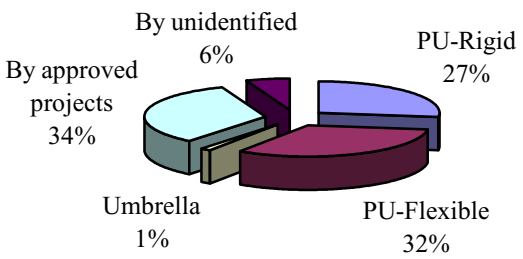
2.9 Though there were many CFC phaseout projects being implemented prior to 1999, the consumption of CFC was not significantly reduced at the national level, mainly because of the combination of rapid economic growth and relatively few national controls on consumption before 1999. In fact, the consumption of CFC would be expected to decrease after 1999, because of national CFC production controls, bans on new installations, and the impact of previous approved projects.

Table 2.5: 1999 CFC Consumption in the PU Foam Sector (MT)

	Flexible		Rigid foam		Integral skin		Total	
	Total	Eligible	Total	Eligible	Total	Eligible	Total	Eligible
Consumption by identified enterprises	6,222	5,342	5,160	4,510	34	34	11,416	9,885
Consumption by unidentified enterprises	602	421	492	345	0	0	1,094	766
Residual CFC consumption in the PU foam sector to be phaseout							**12,510**	**10,651**
Proposed 2001 UNIDO umbrella project			237	237			237	237
CFC Consumption not covered by ongoing projects							12,747	10,888
CFC 11 consumption to be captured by ongoing MLF funded projects							6,415[1]	6,415
Total 1999 CFC 11 consumption							19,162	17,303

1/ The amount of 6,415 MT of CFC-11 in the PU foam sector includes the consumption by enterprises that had projects approved in 2000.

Figure 2.2: Consumption of CFC-11 in PU Foam Sector



2.10 By the end of 1999, ongoing projects consumed 6,415 MT of CFC-11 in the PU foam sector, including consumption by enterprises that had projects approved in 2000. The residual consumption of CFC-11 in the PU foam sector was 12,510 MT. The consumption by 408 identified enterprises was 11,416 MT in 1999. Although the number of identified enterprises is about 50% of the total number of enterprises, the total consumption of these enterprises was about 90% of the total consumption in 1999. Based on the analysis of the survey (Chapter III), the unidentified enterprises are all small size enterprises, such as box foam and small rigid foam producers.

2.11 As shown in survey from table 3.2-3.8, the total unidentified CFC-11 consumption was 1,094 MT. It is assumed that all unidentified consumption is by small enterprises. The eligibility rates for small rigid foam producers and flexible foam producers are 60.6% and 76.8% respectively, thus in this sector, the eligibility rate for unidentified CFC-11 consumption is 70% (average of small rigid and flexible foam producers). Therefore, the eligible consumption by unidentified users is 766 MT. **The eligible rate for consumption to be phased out under this sector plan is 85.1%.**

2.12 The consumption of CFC-11 in the PU foam sector in the base year is shown below.

Table 2.6 Consumption of CFC-11 in PU foam sector in the base year (1999)

	MT
Consumption by ongoing projects approved before 2000	5,498
Projects approved in 2000	1,220
Deduct the consumption of 4 returned projects	-303
Subtotal -- consumption by ongoing projects	**6,415**
Identified eligible consumption for the sector plan	9,885
Unidentified eligible consumption for the sector plan	766
Subtotal of eligible consumption for the sector plan	**10,651**
Proposed UNIDO project, expected to be approved in 2001	**237**
Ineligible consumption will be phaseout under the sector plan	**1,859**
Total consumption of CFC 11 in 1999	**19,162**

C. PREVIOUS PHASEOUT ACTIVITIES IN THE FOAM SECTOR

2.13 China has introduced a range of measures relating to CFC phaseout. These measures include:

a) In 1997, SEPA, State Development and Planning Committee, State Economic and Trade Committee, and State Industrial and Commercial Administration jointly issued a Circular on Bans of Establishment of New Production Sites for Production and Consumption of ODS;
b) Several seminars were held with international support on CFC alternative technologies for foam sector enterprises;
c) Many activities promoting awareness were carried out via conferences, TV, newspapers, and other media;

d) In March 1999, the ExCom approved the CFC Production Sector Plan and China started phaseout of CFCs production. Future CFC production would be limited under that sector plan; and
e) Domestic research institutes and enterprises have started to develop substitutes and alternative technologies, and have made progress in laying the foundations for CFC phaseout in the foam sector.

2.14 **Financing from MLF:** By the end of 2000, there was a total of 163 approved projects in the foam sector. Of these, 61 were PU rigid projects, 41 were PU flexible foam investment projects, and 10 were integral skin projects. The total phaseout amount for CFC-11 through these projects is 10,222 MT ODP.

2.15 The information for approved projects in the foam sector (PU foam and extruded Polystyrene foam) is summarized below.

Table 2.7: Approved fund and phaseout targets in Foam Sector at end 2000 (MT)

Subsectors	No. Projects	Investment Projects (US$)	Non-Investment Projects (US$)	ODP to be Phased out (MT)	ODP already Phased out (MT)
CFC-11					
Flexible[1]	41	16,820,849		3,876	1,832
Integral skin	10	1,914,095		180	20
Rigid	61	41,398,156		5,904	1,758
Multiple-subsector[2]	2	852,600		77	77
Polystyrene/polyethylene[2]				185	185
Sub-total				10,222	3,872[3]
CFC-12					
Polystyrene/polyethylene[2]	27	20,054,867		5,102	3,259
Others					
Polyol Production	3	1,005,000			
TA	5		880,019		
Project Preparation	14		1,030,000		
Total	**163**	**82,045,567**	**1,910,019**	**15,139**	**6,946**
Total Approved (US$)					**83,955,586**

1/ Four flexible foam projects have been returned to MLF with total phaseout target/fund of 303 MT and US$1,889,559.

2/ Both Multiple-sub-sector and Polystyrene/polyethylene contain 77 MT and 185 MT CFC-11 phaseout, respectively.

3/ 3,872 MT ODP was phased out by the end of 2000. By the end of 1999, 3504MT ODP was phased out by completed projects.

2.16 **ODS phased out through MLF support**. A total of 10,222 MT ODP of CFC-11 will be phased out by approved projects. Since the annual amount of CFC phased out cannot be directly estimated from the current MLF and China's database, sampling data of projects is used to setup assumptions to estimate the consumption phased out by approved projects. Project implementation in the years after project approval is shown in Table 2.8. According to the assumption demonstrated in table 2.8, if a project with 100 MT phaseout target was approved in 1997, the

phaseout impact will be 50 MT in 1999, 30 MT in 2000 and the remaining impact of 20 MT in 2001.

Table 2.8: Project implementation after project approval

Project Implementation after approval[1]	**Schedule** (cumulative)
Within 1 year	0%
Within 2 years	0%
Within 3 years	50%
Within 4 years	80%
Within 5 years	100%
Within 6 years	-

1 It is assumed that implementation speed for this sector plan will be faster than individual projects implementation. Details are in Chapters IV and VI.

2.17 By the end of 1999, ongoing projects consumed 5,498 MT; also, projects accounting for 1,220 MT CFC-11 were approved in 2000. However, as four projects which were approved in 1999 have been returned to MLF with total phaseout target of 303 MT, the total amount of consumption by ongoing projects in 1999 is 6,415MT. The remaining consumption of CFC-11 at the 1999 baseline is 12,747 MT. Excluding the 237 MT of CFC-11 for the proposed UNIDO umbrella project, the remaining 12,510 MT of CFC-11 will be phased out under this sector plan.

Table 2.9:Phaseout Status of Approved CFC-11 Projects in Foam Sector

Approved in the sub-sector (MT)	1993	1994	1995	1996	1997	1998	1999	2000	Total
Rigid	430	235	190	272	837	946	2,103	891	5,904
Flexible	180	443	620	562	0	379	1,364	329	3,876
Integral skin		20	39				121		180
Multiple sub-sector			77						77
PS/PE		130	55						185
Total approved in the year	610	828	981	834	837	1,325	3,588	1,220	10,222
Completed amount in the year	0	0	305	597	861	877	865	1,080	4,584
Projects were returned							235	67	
Consumption by ongoing projects	610	1,438	2114	2,351	2,326	2,775	5,263	5,334	

* For validating the above calculation of phaseout status, FSWG has conducted a survey to investigate phaseout status. Based on the survey, the remaining consumption of the ongoing projects in the baseline year is 4,810 MT. It is lower than the calculation and that means there is more unidentified consumption. Meanwhile, the database of the MLF secretariat shows that the completed phaseout by Auguest 2000 is 3,687 MT. It is close to the calculation data. However, the FSWG decided to use calculation data as the remaining consumption because it is closer to the period stataus.

D. ISSUES

2.18 Phaseout activities in the foam sector are a challenge, as it is the largest CFC consuming sector. The main issues for CFC phaseout in foam sector include:

a) **Need for an efficient phaseout approach**. Most foam enterprises are very small, privately owned and widely distributed. Phaseout of CFCs through a project-by-project approach is too time consuming to meet the Montreal Protocol requirements. Also, China's economic system is changing from a planned system to market-driven system, which decreases the government's ability to manage enterprises directly or to set up a mechanism for implementing phaseout through administrative means.

b) **Need to ensure consistency between CFC production and consumption phaseout.** Since the Sector Plan for CFC production phaseout was approved in March 1999, the CFC production phaseout targets were agreed between ExCom and China. The controlling of CFC production has already started. The foam sector must therefore comply with the supply decrease.

c) **Suitable alternative technologies must be available**.

   i. Safety and health issues. Though there are some alternative technologies available for conversion, there is a need for investment and training in safety and health issues.
   ii. Quality of products and ease of operation. Compared to CFC-11 technology, alternative technologies are more complicated and it is more difficult to ensure quality control of products.
   iii. HCFC-141b. As a HCFC, HCFC-141b is a transitional substitute and will be regulated in future. Enterprises using HCFC-141b as alternative will have to face a second round of phaseout.
   iv. Financial issue. Due to the low thresholds for costs of conversion, enterprises have had to invest a great deal of capital costs for the conversion. For many enterprises, it is very difficult to solve the financial issue.

d) **Enterprises have limited knowledge about CFC phaseout.** Enterprises, especially small users, do not have sufficient knowledge about CFC phaseout policies, technical options and costs, and they also do not have sufficient knowledge about their obligations and rights in ODS phaseout. Smaller enterprises have limited opportunities to obtain affordable alternative technologies as they lack information on substitutes and alternative technologies. There is a need to improve research, propagation and public education.

e) **Market competition** Since the production costs for CFC technology and alternative technology are different, the different costs would result in unfair competition. This would especially affect enterprises that planned to phaseout CFC earlier without MLF funding.

III. SURVEY OF CFC-11 CONSUMPTION IN THE PU FOAM SECTOR

A. SURVEY METHODOLOGY AND RESULTS

3. 1 The Foam Special Working Group (FSWG) under PMO started a data survey in April 1999. In April, July and October 1999, the FSWG, together with the China Plastics Processing Industry Association and local associations, conducted data surveys by sending questionnaires to and visiting over 600 enterprises in 31 provinces in China. The field data surveys assimilated the lessons learned from the solvent sector. The FSWG and industrial associations put a lot of emphasis on public information workshops to facilitate information sharing by enterprises. As foam enterprises are mainly small and medium enterprises (SMEs) and managers take responsibility for the CFC phaseout directly, communication between FSWG and enterprises was conducted much more easily than in the solvent sector (which are mainly large enterprises) surveys. However, the foam SMEs tend to be dispersed widely geographically, making it difficult to survey all of them. Excluding the enterprises which have phased out or are phasing out CFC use with MLF support, over 600 enterprises were reached by FSWG. However, sufficient data could only be obtained from 408 enterprises to justify their classification as identified enterprises. Besides the 408 enterprises, 8 rigid PU foam producers, which consumed 237 MT CFC-11 in 1999, would apply for MLF funding as an umbrella project by UNIDO in the 34th ExCom meeting.

Table 3.1:Classification of CFC PU Foam Consumers

Consumption amounts (MT ODP)

	Large-sized enterprises	Medium-sized enterprises	Small-sized enterprises
PU Flexible*	>150	25-150	<25
PU Rigid*	>30	10-30	<10
Integral skin*	>30	10-30	<10

*Size category from UNEP/Ozl.Pro/ExCom/19/54

3. 2 Table 3.1 shows the classification for this sector plan as suggested by the ExCom guidelines. However, under this classification no enterprise would qualify to belong to the large size PU flexible category from identified enterprises. Taking into account the actual distribution of PU flexible enterprises and the guidelines for CO_2 alternative technology, medium size PU flexible producers were separated into two groups. The medium size group I consumes between 50-150 MT per year, and the medium size II group consumes between 25-50 MT per year.

3. 3 Table 3.2 – 3.8 present information of baseline equipment, CFC-11 consumption in the last five years, eligibility of CFC-11 consumption in rigid, flexible and integral foam sub-sectors and provincial distribution of enterprises. The eligibility rates are calculated based on the ExCom decision (*UNEP/Ozl.Pro/ExCom/17/60, Decision 17/7 para.15*). The eligibility rate in 1999 is decided by the number of foaming machines representing production capacity installed before July

1995 divided by the number of foaming machines representing current production capacity.

3. 4 There are three– types of foam equipment consuming CFC 11 :

a) Type I refers to equipment installed before July 1995. CFC-11 consumed by these equipment is eligible for compensation. (Number of Type I equipment= 461)

b) Type II refers to equipment installed after July 1995 but as replacements for retired equipment installed before July 1995, with no increase in capacity. CFC-11consumed by these equipment is eligible for compensation. (Number of Type II equipment= 60)

c) Type III refers to equipment installed after July 1995; this represents new production capacity. Thus, CFC-11 consumed by these equipment is not eligible for compensation. (Number of Type III equipment=586-461-60=65)

Table 3.2: Identified CFC-11 Consumption for PU Rigid Foam (not yet Funded)

	# of enter-prices	Number of equipment	Number of eligible equipment*		Consumption (MT)					Eligibility rate in 1999 %	Average size (MT)	Eligible consumption in 1999
			Installed before 07-1995 (type I)	Replace-Ments (type II)	1995	1996	1997	1998	1999			
All enterprises	**179**	**586**			**3,235**	**3,941**	**4,258**	**5,066**	**5,160**	**87.4**	**28.8**	
Large-sized enterprises	59	227			1,689	2,341	2,719	3,266	3,420	90.3	58.0	
Medium-sized enterprises	84	290			1,253	1,318	1,288	1,575	1,561	84.1	18.6	
Small-sized enterprises	36	69			294	281	251	224	179	60.6	5.0	
Eligible enterprise	**152**	**552**	**461**	**60**	**3,116**	**3,761**	**4,038**	**4,698**	**4,762**	**94.7**	**31.3**	**4,510**
Large-sized enterprises	55	221	175	34	1,689	2,263	2,689	3,171	3,266	94.6	59.4	3089
Medium-sized enterprises	72	272	237	23	1,162	1,261	1,142	1,363	1,374	95.6	19.1	1313
Small-sized enterprises	25	59	49	3	265	236	208	164	123	88.1	4.9	108
Ineligible enterprises	**27**	**34**	**0**		**120**	**180**	**220**	**367**	**398**		**14.7**	
Large-sized enterprises	4	6			0	78	30	95	154		38.5	
Medium-sized enterprises	12	18			90	57	147	212	187		15.6	
Small-sized enterprises	11	10			29	45	43	61	56		5.1	

Table 3.3 Distributions of Equipment Application in Rigid PU Foam

	Number of enterprises				Number of eligible spray equipment		Number of eligible dispenser equipment				# of in-eligible equipment	# of total equipment
	Spray	board	Pipe	total	H-P spray (import)	L-P spray (domestic)	H-P dispen-ser import	H-P domestic dispenser	l-P import dispenser	l-P domestic dispenser		
All enterprises	114	59	80	179	63	285	10	1	0	102	127	586
large-sized enterprises	41	24	26	59	20	107	4	1	0	43	52	227
Medium-sized enterprises	58	24	33	84	37	152	4	0	0	44	53	290
Small-sized enterprises	15	11	21	36	6	26	2	0	0	15	22	69
Eligible enterprises	106	50	69	152	63	285	10	1	0	102	91	552
Large-sized enterprises	40	22	25	55	20	107	4	1	0	43	46	221
Medium-sized enterprises	54	21	27	72	37	152	4	0	0	44	35	272
Small-sized enterprises	12	7	17	25	6	26	2	0	0	15	10	59
Ineligible enterprises	10	9	11	27							34	34
Large-sized enterprises	1	2	1	4							6	6
Medium-sized enterprises	4	3	6	12							18	18
Small-sized enterprises	5	4	4	11							10	10

Table 3.4 : Identified CFC-11 Consumption for PU Flexible Foam (not yet funded)

	# of enter-prises	# of equip ment	#of eligible equipment		Consumption (MT)					Eligibility rate in 1999 (%)	Average size (MT)	Eligible Consump-tion (MT)
			Installed before 07- 1995	Substi-tutes	1995	1996	1997	1998	1999			
All enterprises	**225**	**250**			**3,952**	**4,758**	**5,292**	**5,892**	**6,222**	**85.8**	**27.7**	
Medium-sized–I	62	75			1,820	2,463	2,741	3,844	4,316	90.7	69.6	
Medium-sized–II	36	43			1,226	1,600	1,922	1,457	1,333	74	37	
Small-sized	127	132			906	695	629	591	573	76.8	4.5	
Eligible enterprises	**200**	**224**	**214**	**0**	**3,789**	**4,482**	**4,930**	**5,495**	**5,753**	**92.8**	**28.8**	**5,341**
Medium-sized–I	60	73	68	0	1,820	2,463	2,741	3,844	4,202	93.2	70	3,914
Medium-sized–II	28	34	31	0	1,226	1,440	1,667	1,177	1,082	91.2	38.6	987
Small-sized	112	117	115	0	743	579	522	474	469	93.9	4.2	440
Ineligible enterprises (Type III)	**25**	**26**	**0**		**163**	**276**	**362**	**397**	**469**		**18.8**	
Medium-sized–I	2	2			-	-	-	-	114		56.8	
Medium-sized–II	8	9			-	160	255	280	251		31.4	
Small-sized	15	15			163	116	107	117	104		6.9	
Continuous foam	**125**	**150**	**123**		**3,770**	**4,659**	**5,186**	**5,780**	**6,120**	**85.7**	**57.7**	
Medium-sized–I	62	75	68		1,820	2,463	2,741	3,844	4,316	97.4	69.6	
Medium-sized–II	36	43	31		1,226	1,600	1,922	1,457	1,333	81.2	37	
Small-sized	27	32	24		724	596	523	479	471	79.4	17.4	
Eligible users	**109**	**133**	**123**		**3,609**	**4,384**	**4,826**	**5,389**	**5,658**	**92.7**	**51.9**	**5,246**
Medium-sized–I	60	73	68	0	1,820	2,463	2,741	3,844	4,202	93.2	70	3,914
Medium-sized–II	28	34	31	0	1,226	1,440	1,667	1,177	1,082	91.2	38.6	987
Small-sized	21	26	24	0	563	481	418	368	374	92.3	17.8	345
Ineligible users (Type III)	**16**	**17**	**0**		**161**	**275**	**359**	**391**	**462**		**28.9**	
Medium-sized–I	2	2			-	-	-	-	114		56.8	
Medium-sized–II	8	9			-	160	255	280	251		31.4	
Small-sized	6	6			161	115	104	111	97		16.2	
Box Foam	**100**	**100**	**91**		**182**	**99**	**106**	**112**	**102**		**1**	
Medium-sized–I	0	0	0									
Medium-sized–II	0	0	0									
Small-sized	100	100	91		182	99	106	112	102			
Eligible box foam users	**91**	**91**	**91**	**0**	**180**	**98**	**103**	**106**	**95**		**1**	**95**
Ineligible box foam (Type III) users	**9**	**9**			**3**	**1**	**3**	**6**	**7**		**0.8**	

Medium sized I enterprises are those enterprises which consumed between 50 to 150 MT CFC

Medium sized II enterprises are those enterprises which consumed between 25 to 50 MT CFC

Small sized enterprises are those enterprises which consumed less than 25 MT CFC.

Table 3.5: Identified CFC-11 Consumption for Integral Skin Producers (not funded)

Number of enterprises	No. of equipment	No. of eligible equipment	Consumption (MT)					Eligibility rate in 1999 (%)	Average size (MT)
			1995	1996	1997	1998	1999		
4	4	4	19	24	50	25	34	100	8.6

[1/] There are currently about 100 small producers of integral skins. Some of them have already been financed by the MLF. Some are not using CFCs. Most of these are very small operations with one to two workers. Some production is carried out manually, and results in very little CFC consumption (less than 500kg/year of CFC 11). They are not included in this sector plan because of lack of information. When CFC production is phased out, these small producers will be eliminated automatically.

Table 3.6: PU Rigid Foam Enterprises (not funded) and Their Consumption in 1999

	Province/Municipality	Number of enterprises	consumption in 1999	
			MT	Percentage (%)
1	Zhejiang	14	723	14.0
2	Shandong	25	705	13.7
3	Heilongjiang	15	543	10.5
4	Gansu	16	457	8.9
5	Guangdong	10	388	7.5
6	Jiangsu	12	300	5.8
7	Xinjiang	7	296	5.7
8	Beijing	8	279	5.4
9	Hubei	8	204	4.0
10	Liaoning	9	192	3.7
11	Shanghai	4	178	3.4
12	Henan	8	153	3.0
13	Hebei	5	122	2.4
14	Shaanxi	9	117	2.3
15	Ningxia	8	105	2.0
16	Jilin	5	81	1.6
17	Sichuan	1	76	1.5
18	Shanxi	3	55	1.1
19	Yunnan	2	53	1.0
20	Qinghai	1	36	0.7
21	Hainan	1	30	0.6
22	Chongqing	2	20	0.4
23	Fujiang	1	18	0.3
24	Tianjin	1	12	0.2
25	Tibet	1	10	0.2
26	Hunan	2	6	0.1
27	Guangxi	1	1	0.0
Total		**179**	**5,160**	100.0

Table 3.7: PU Flexible Foam Enterprises (not funded) and Their Consumption in 1999

	Province/Municipality	Continuous Foam		Box Foam		Total CFC-11 Consumption in 1999	
		# of enterprises	Consumption in 1999 (MT)	# of enterprises	Consumption in 1999 (MT)	MT	Percentage (%)
1	Sichuan	12	1067	42	47	1113	17.9
2	Henan	13	979			979	15.7
3	Hebei	15	809			809	13.0
4	Jiangsu	21	800	1	1	801	12.9
5	Zhejiang	14	548	8	7	555	8.9
6	Shandong	6	328	2	2	329	5.3
7	Guangdong	7	316	7	8	324	5.2
8	Shanghai	7	224			224	3.6
9	Anhui	4	198			198	3.2
10	Yunnan	5	149	12	9	158	2.5
11	Liaoning	2	140			140	2.3
12	Shaanxi	3	114			114	1.8
13	Guizhou	3	89	24	25	114	1.8
14	Fujiang	2	106			106	1.7
15	Shanxi	3	61	1	0	61	1.0
16	Hubei	2	61			61	1.0
17	Xinjiang	1	60			60	1.0
18	Heilongjiang	3	33	3	3	36	0.6
19	Inner Mongolia	1	20			20	0.3
20	Ningxia	1	20			20	0.3
21	Chongqing	0	0			0	0.0
Total		**125**	**6,122**	**100**	**102**	**6,222**	**100.0**

Table 3.8: Integral Skin Foam Enterprises (not funded) and Their Consumption in 1999

	Province/ Municipality	**Number of Enterprises**	**Total Consumption in 1999**	
			MT	**Percentage (%)**
1	Jiangsu	3	31.2	91.0
2	Shandong	1	3.0	9.0
Total		4	34.2	100.0

3. 5 The average size of PU foam producers in China is about 28 MT, small by international standards. Chinese foam producers generally produce for local and regional rather than national markets because of the difficulty and the high cost of transporting foam products over long distances in China. Tables 3.2-3.8 present summaries of the data on enterprises obtained from

enterprise surveys conducted during the preparation of the Foam Sector Plan. Enterprises which were included in the proposed UNIDO umbrella project to be submitted to the 34th ExCom meeting are excluded from the above tables. The following data analysis excludes the proposed UNIDO umbrella project and assumes its approval.

3. 6 The total identified CFC-11 consumption is 11,416 MT in 1999 and eligible consumption is 9,885 MT. The eligible rate for the total identified consumption is 86.6%. The eligibility rates are 87.4% for PU rigid and 85.8% for PU flexible identified enterprises. The total amount of 11,416 MT CFC-11 was consumed as follows: (a) 5,160 MT or 45.2% by PU rigid enterprises, (b) 6,222 MT or 54.5% by PU flexible enterprises, and (c) 34 MT or 0.3% by integral skin enterprises . These producers have not yet received any MLF assistance. The CFC-11 consumption by large-size enterprises is 66% (3,420 MT) of the total identified consumption in the PU rigid sub-sector. There are no large-size enterprises in the PU flexible sub-sector. The total consumption of CFC-11 by enterprises using the continuous-foaming method is 98% (6,120 MT) of total identified consumption in PU flexible sub-sector. The box foam share is only 2% (102 MT).

3. 7 Based on the survey data, only two identified enterprises are foreign-owned. The main reason for the ineligibility for MLF funding is because companies were set up after July 1995. The tables also show that the average size of an ineligible enterprise is smaller than that of an eligible enterprise. The reasons are: (a) the older eligible enterprises are state-owned; they are usually larger than private companies in the initial stage, and (b) China started to control construction of new production lines at the end of 1997, since then it is not allowed to build new enterprises with CFC technology. Generally, the larger new foam enterprises selected alternative technology after 1997. The new enterprises with CFC technology are mainly small size enterprises.

IV. PHASEOUT STRATEGY

A. INTRODUCTION

4.1 The foam sector phaseout strategy has been established based on the historical development and the present structure of the foam industry in China, including the present status of ODS phaseout, as well as forecasts of production and consumption of CFCs and their substitutes, with the objective of developing and implementing the most efficient and cost-effective phaseout program possible. The foam sector is a rapidly growing sector, and it is very important that the strategy is designed to minimize any adverse impact on its development.

4.2 This sector plan only addresses the PU foam sector (PU Rigid foam, PU Flexible foam and Integral skin foam), and is limited in terms of its funding application, action plan and operational mechanism to the phaseout of remaining CFC-11 consumption as a foaming agent in the PU foam sector.

B. PHASEOUT SCHEDULE

4.3 Table 4.1 provided national supply of CFC-11 consumptions by sectors and phaseout schedule of the PU foam sector.

Table 4.1 Supply & Demand of CFC-11 and Phaseout Schedule

	1999 base year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
National CFC-11 Supply												
CFC-11 production	22,681	18,153	16,700	16,400	15,000	13,100	10,400	7,700	4,130	3,800	300	0
Net import	1,924	1,308	1,200	800	500	0	0	0	0	0	0	0
Inventory reduction	1,000 [1]											
Total supply of CFC-11	*25,605*	*19,461*	*17,900*	*17,200*	*15,500*	*13,100*	*10,400*	*7,700*	*4,130*	*3,800*	*300*	*0*
CFC-11 Consumption by Sectors												
Tobacco	1,037	1,000	1,000	880	700	500	300	150	0			
I&C	606	595	586	577	570	534	454	386	309	247	198	0
HH Ref.	4,800	2,600	2,100	1,600	400	400	0					
Foam	19,162	15,266	14,214	14,143	13,830	11,666	9,646	7,164	3,821	3,553	102	0
Total CFC-11 consumption	*25,605*	*19,461*	*17,900*	*17,200*	*15,500*	*13,100*	*10,400*	*7,700*	*4,130*	*3,800*	*300*	*0*
Phaseout Targets and Projects Impacts (MT) in Foam Sector												
Foam consumption target	19,162	15,266	14,214	14,143	13,830	11,666	9,646	7,164	3,821	3,553	102	0
Phaseout targets for the sector plan (12071MT)			2,000		2,000	2,500	2,500	2,500	571			
Phaseout impact of previous approved projects			2,241	1,847	1,135	349						
Phaseout impact of Sector Plan (12071MT)					0	1,000	2,000	2,250	2,500	2,500	1,821	

[1] Inventory reduction=inventory at the end of 1999 minus inventory at the beginning of 1999.

4.4 Table 4.1 shows the CFC-11 consumption and annual phaseout targets in the PU foam

sector. The PU foam sector plan phaseout targets are as follows:

a) All eligible CFC-11 consumption will be phased out by the end of 2009;
b) All ineligible CFC-11 consumption in ineligible enterprises will be phased out by controlling CFC-11 supply; and
c) total phaseout of CFC-11 consumption will be achieved by the end of 2009.

C. APPROACH TO PHASEOUT CFC-11 IN PU FOAM SECTOR

4.5 The overall approach to the phaseout of CFC-11 under this sector plan will include multiple approaches to reflect diverse structure of the industry, such as the size and number of enterprises, and the characteristics of the sub-sector. The plan will consider the limited supply of CFC-11 at the national level under the CFC production sector plan and will control the import of CFC-11. The phaseout targets in the plan will be achieved by a series of annual programs. The main operating mechanism to implement the sector plan include the use of bidding system to provide market incentives for enterprises to phaseout early, a technical support system, a voucher system to help small enterprises, and policies initiatives to phase out the consumption, particularly ineligible consumption.

4.6 To ensure the implementation of the sector plan, large, medium and small eligible enterprises will be treated differently. Most large and medium enterprises will carry out phaseout activities through a bidding system. Some large and medium enterprises will be encouraged to merge with some small enterprises by industrial restructuring and consolidation on a sub-sector and/or regional basis, and to submit bids as a group company. Some smaller enterprises will be provided vouchers for equipment and/or technical support.

4.7 Different sub-sectors and regions will phaseout on different schedules. Cost effectiveness is expected to be one of the key factors for determining the pace of phaseout in different sub-sectors and regions. It is expected that the phaseout activities of small enterprises will be more difficult because of higher conversion costs.

4.8 **Bidding system**: ODS phaseout in large, medium and some small foam enterprises will be implemented through a bidding system to reach the approximately 200 enterprises. The bidding system will be similar to the procedures already designed and being used successfully under the Halon Sector Plan. The Domestic Implementing Agency (DIA) will conduct annual bidding. Each successful bidder will enter into an ODS Reduction Contract with SEPA. The ODS Reduction Contract will specify the terms and conditions under which ODS reduction will be accomplished. Implementation of all ODS Reduction Contracts will be done in accordance with procedures agreed with the World Bank.

4.9 **Voucher System for small enterprises**: CFC-11 phaseout in some small foam enterprises will be implemented through a voucher system to reach the large number of small

CFC-11 users. PMO expects this system will be operational around the third or fourth years of implementation of this sector plan. A detailed operating mechanism will be developed in the first two years of implementation. The initial proposed operation of the voucher system is summarized below:

a) PMO/DIA will introduce the Foam PU Sector Phaseout Plan and provide information to provincial/local industrial associations, equipment and polyol suppliers through various workshops and promotional activities. These agencies will be requested to assist in identifying a list of small CFC users. With the support of various agencies, the small user will be primarily responsible for its registration with DIA with verified documentation of its registration with the Industrial and Commercial Administration, its CFC consumption and foam production record , and for submission of its voucher application to DIA;
b) Small foam enterprises which have obtained approval from the DIA in this manner, will be provided vouchers that will enable them to buy equipment, or obtain technical support or alternatives from the designated equipment and technology support providers with the vouchers received. The small enterprise would redeem the voucher directly with DIA after its conversion project is designed and ready for contract(s) signing with the designated participant(s). Redeeming the voucher will obligate the small enterprises to stop using CFC-11 within an agreed period as a condition of payment. The agreed completion time and implementation plan will be part of the agreement (in the form of a contract) with DIA;
c) The DIA will conduct periodic reviews on a sample of small enterprises who receive vouchers. The DIA will also prepare progress and completion reports to PMO on results and payments under the voucher system.

4.10 **Technical Support System (TSS):** Because of limitations in technology, information collection and management expertise, small enterprises may face difficulties in selecting and using the most appropriate substitute technology. A technical support system will be set up to provide substitute technologies, formulation and technical consultation to such enterprises. The TSS will be established in institutes or universities and there will be 3-4 technical support centers nationwide under the System.

4.11 **Ineligible enterprises**: Ineligible enterprises will not be funded under the sector plan. The CFC-11 consumption phaseout of these enterprises will be realized via the following policy initiatives and measures: (1) Notice on banning newly-built production facilities which produce or use ODS. China will intensify monitoring of this policy to prevent any increases in CFC-11 consumption capacity. (2) With the phaseout of CFC-11 production, the remaining ineligible enterprises will be forced to phaseout their consumption.

D. SELECTION OF SUBSTITUTE TECHNOLOGY

4.12 The following factors are to be considered when selecting substitutes and substitute

technology. The chosen technology should :

a) be benign to the Ozone Layer and the environment;
b) ensure worker safety and health;
c) discourage replacement with low ODP substance or high GWP substance;
d) provide equal capacity as former substances and technologies used; and
e) be cost effective.

4.13 **Flexible Foam**: There are several technology options to replace the use of CFCs in the manufacturing of flexible polyurethane foam (slabstock). Most of them are described and reviewed in the Multilateral Fund's document (UNEP/OzL.Pro/ExCom./16/Inf3). Flexible polyurethane foams options to reduce/eliminate the use of CFCs include:

a) ***Methylene Chloride*** (MC) is the lowest-priced technology. MC is a highly volatile chlorinated substance, and it is classified by the USEPA and by the International Agency for Research on cancer (IARC) as a probable human carcinogen. The U.S. Occupational Safety and Health Administration has set a time weighted average (TWA) at an 8 hour level of 25pmm, (reduced from the previous level of 500 ppm). Similar restrictions are also required (up to 50 ppm) in several other industrialized countries. Safety measures include proper encapsulation of production lines, ventilation, industrial hygienic monitoring and labor training. In addition to health risks, MC is comparatively difficult to process for low density soft foam, and it is not always well received in the foam market.

b) ***AceMTe*** is another substitute. It is extremely volatile (with a low flash point), and therefore presents a high risk of fire and explosion. Any machinery used in the conversion to aceMTe, including ventilation, will need extensive modification to be certified as explosion-proof, and strong safety procedures need to be enforced and monitored. Safety training would have to be provided to the laborers on a regular basis.

c) The ***Variable Pressure Foaming*** process requires the purchase of a completely new foaming machine which is based on the principle of simulating production of low density flexible foam at high altitudes, where the low pressure eliminates the need for a blowing agent to produce foam. The main advantages of this process are: (i) the reduced amount of ventilated gases to control, and (ii) the capability of producing low density foams without blowing agents. The main disadvantages of the process are: (i) the high costs of equipment, and (ii) operating difficulties.

d) The ***Accelerated Cure or Rapid Cure technology*** focuses on the total elimination of auxiliary blowing agents. The general concept of the process is the forced cooling of foam blocks, thus allowing the production of low density water blown foams. If they were not cooled rapidly, foams produced in this manner would ignite due to the heat generated inside the foam from the reaction between water and TDI. The exothermic heat is thus dispersed by drawing air through the block in a relatively short time after production. The main advantages of the process are: (i) elimination of auxiliary

blowing agent (ABA), and (ii) reduction of curing and storage time. The disadvantages are mainly in the area of safety: (i) accurate formulation control is needed, and (ii) electrical/mechanical back up systems are necessary. Any failure in the system can potentially be disastrous due to the fire risk. The rapid cure process is suitable for vertical frothing, but for the horizontal process, too much cooling air will need to be used, increasing energy consumption and operating costs.

e) The ***Liquid Carbon Dioxide*** process (LCD) is based on the injection of liquefied carbon dioxide during or prior to the mixing of the chemicals. The advantages are the production of foams with a superior "feel", good cell structure, operating economies and environmental benefits. The disadvantages are the relatively high initial investment, more complicated processing, a substantial learning curve, and the need to control the exotherm for low density formulation. The technology is the most successful among the recently developed "second generation" CFC replacement technologies. The technology is, however, complicated, and in order to overcome those problems, LCD technology is supplied as a technology package including direct technology support from the provider.

4.14 **LCD:** China has selected LCD as the main substitute technology for flexible foam enterprises with continuous foaming machines because LCD is a environmentally friendly technology and it has zero ODP. The adoption of LCD technology requires installation of equipment that meets the following functions:

a) Bulk storage and temperature control of the liquid carbon dioxide and re-circulation of the carbon dioxide; this also includes refrigerated pipework and valves from the carbon dioxide storage to the inlet of the carbon dioxide metering unit, and an LCD metering and temperature control unit;

b) High pressure material supplying system;

c) High pressure mixing of polyol and carbon dioxide;

d) High pressure mixing head and pipework; and

e) Platform, power panel and control panel, mixing head and froth cleaning unit.

4.15 The use of LCD also requires adjustment of formulations. So far, there has been limited experience in China of adopting local chemicals on LCD slabstock equipment even though there are more than 20 Chinese enterprises selected LCD technology in individual projects. They are either in early stages of implementation or their procurement have just started. The Technical Service System which will be established after the approval of this sector plan will help all LCD users to adjust formulations and modify production process. The experiences of approval LCD projects will be shared with enterprises in the sector plan. SEPA will coordinate the purchase of LCD equipment to enable economies of scale.

4.16 **MC:** Currently, box foam enterprises in China use MC in foam production. Trial runs with MC with increased water levels are found to give satisfactory results and in a cost effective manner, without unacceptable losses in performance and processing. However, as MC is a highly volatile chlorinated substance with a relatively low acute toxicity, the volatility can trigger high concentrations in the air. A well planned reformulation program to handle adjustments in the amounts of blowing agent and catalyst is a pre-condition for safe production. Acceptable industrial hygienic standards are also required to avoid over-concentration in the workplace. Most box foam producers do not have these pre-conditions for MC technology, and during the survey investigations, the survey teams found that many box foam producers use MC in a very unsafe manner. Because of safety concerns, the Government is no longer supporting MC as the blowing agent for the production of PU flexible foam. Even though the Government does not consider it feasible at this stage to ban the use of MC because of economic reasons as also the fact that there are many ongoing projects using MC, further use of MC in the sector plan will be not encouraged, and other alternatives will be explored. As MC is currently the lowest cost alternative to CFCs for small box foam producers, the incremental cost calculation in the sector plan will use the cost of MC conversion as the basis of conversion for box foam producers. During implementation of the sector plan, the Government will provide technical assistance on safety and health concerns for existing MC users, and promote safety requirements on MC technology. During the sector plan implementation, the Government will promote other alternatives (such as variable pressure foam technology) to box foam enterprises where feasible; however, box foam enterprises will be allowed to apply for MC technology if no other alternative is available, so that the foam sector plan can be implemented successfully and China can meet its MP commitments.

4.17 **Variable Pressure Foam (VPF)** would be a preferred solution. However, based on price information from foreign suppliers, it will not be financially feasible to convert a majority of the enterprises to VPF. In addition, most of the enterprises have very low CFC consumption (below 2 MT), and an assumed cost of US$ 100,000/unit will not be cost-effective. Though VPF is not included in the costs calculation, VPF will still be considered as a solution for small size enterprises . The Government will encourage closure or merger of some smaller box foam enterprises in the same city/province.

4.18 **Rigid Foam**: The three currently prevailing phase out technologies used in China for PU rigid foam products are cyclopentane, water blown and HCFC-141b technologies. Other technologies such as HCFC-22/142b and HFC-134a can also be used but these technologies always require new equipment and extensive adjustment of the current production process. In addition, some manufacturers have introduced vacuum panels but the technology is still under development.

a) ***Pentane*** technology is commercially proven and is extensively used in Europe. It has zero ODP and GWP, but it is flammable and needs a careful review of manufacturing

operations with respect to the safe handling of a flammable foam-blowing agent. Seven Chinese enterprises have previously selected cyclopentane technology through individual projects and their experience will be shared with enterprises under sector plan.

b) ***Water blown*** technology is another zero ODP technology and is commercialized in China for the application of non-insulation foam. The disadvantage of water blown technology is that it requires changes of foaming machines and formulations.

c) ***HCFC-141b*** technology requires the least changes both in machinery and in formulation of chemicals. Because of the safety costs related to hydrocarbons, it is not cost-effective to use cyclopentane in smaller enterprises. In addition, cyclopentane cannot be used in spray foam equipment. HCFC-141b will be used by the majority of enterprises because of these considerations. Additionally, HCFC-141b polyols are available in the Chinese market and a conversion to HCFC-141b would limit the conversion costs for smaller enterprises with smaller CFC consumption. However, this is an interim (non-zero ODP) solution for which final solutions are still under development, and which will not be funded by the MLF later once the option to use HCFC-141b has been exercised.

4.19 Eighteen enterprises under this sector plan will select cyclopentane technology. Between cyclopentane and n-cyclopentane, the Chinese government will encourage these enterprises to use cyclopentane because it offers better insulation value. The following actions need to be taken by these eighteen enterprises to be able to adopt cyclopentane:

a) external (underground recommended) cyclopentane storage tank and pump;
b) new polyol/cyclopentane premixing stations;
c) enclosure and emission control systems for the premix and dispensing station;
d) upgrading of electrical equipment within the enclosure to the IP-54 standard;
e) grounding of all equipment handling cyclopentane;
f) coating anti-static paint on floor area of the foaming section;
g) jig modifications to the injection hole closure, and to prevent premature opening;
h) cyclopentane monitoring of all critical areas with data recording and printing to enable retroactive fault analysis; and
i) safety audit and training.

4.20 According to Chinese regulations, these eighteen enterprises will need to acquire certificates from local fire fighting bureaus to produce foam products using hydrocarbons.

4.21 The remaining enterprises under this sector plan will select HCFC-141b technology. HCFC-141b and HCFC-141b systems are already in the domestic market for panel, pipe, and spray foam. Enterprises which already have high pressure foaming machines need to retrofit their baseline equipment to apply new HCFC-141b systems. Enterprises which have low

pressure foaming machines will in most cases need to purchase high pressure foaming machines in order to use HCFC-141b.

4.22 **Integral Skin Foam:** The presently available substitute technologies for integral skin foams are hydrocarbons, water blown and HCFC-141b.

a) ***Hydrocarbon*** is a zero ODP solution which has been used by some European companies. It requires a significant amount of change in the production process to meet safety requirements. It is large production capacity. Hydrocarbon has not been selected in this sector plan because the four integral skin foam enterprises are all small producers.

b) ***Water blown*** technology is also a zero ODP solution. The flow and cure characteristics during foaming are not identical to CFC-11 and HCFC-141b. It requires in-mold coating to ensure uniform surface. It also requires the change of testing method and quality standards of final products. Water blown technology is promoted by China's State Economic and Trade Commission.

c) ***HCFC-141b*** is an interim solution. The process conditions of HCFC-141b is very similar to that of CFC-11. The safety issue is minor and the quality of the final product will be very close to that of CFC-11. The disadvantage of this option is that HCFC-141b still has an ODP of 0.11.

4.23 All Four integral skin foam enterprises under this sector plan will select water blown technology. They will purchase in-mold coating machines, install ventilation system, and modify molds.

E. INFORMATION ON EQUIPMENT AND CHEMICAL SUPPLIERS

4.24 Foam equipment in China is supplied by both domestic and international suppliers.

4.25 **Foam Dispensers:** The suppliers for foam dispensers are as follows:

a) Cannon
b) Chengdu Qingrong
c) EMB
d) Hennecke
e) Krauss-Mafei
f) Leqing Chuangxin Pump Plant
g) OMS
h) Perros
i) WEMA
j) Wenzhou Xiangyang
k) Wuhan Light Industry Machinery Plant

4.26 Among these suppliers, Wenzhou Xiangyang and Leqing Chuangxin Pump Plant produce only low pressure foam dispensers. Most foam dispensers in China are high pressure foam dispensers supplied by international suppliers, and less than one-tenths of foam dispensers in the Chinese market are produced by domestic suppliers.

4.27 Suppliers for spray foam machines are as follows:

a) Glas-Craft
b) Gusmer
c) Graco
d) Hovmand
e) Intergun
f) OMS
g) Hennecke
h) Secmer
i) Wuhan Light Industry Machinery Plant
j) Leqing Shengli Spray Foam Plant
k) Leqing Tiangle Spray Foam Plant
l) Leqing Tianle Machinery Plant
m) Hebei Yutian Agriculture Machinery Plant
n) Henan Zhumadian Plastic Machinery Plant
o) Jiangsu Kezhao Plant
p) Fushun Jingying Polyurethane Foam Plant

4.28 **Spray Foam Machines:** Like foam dispenser suppliers, all domestic spray foam manufacturers can only produce low pressure spray foam machines. However, domestic spray foam manufacturers occupy more than 50% of the spray foam machine market.

4.29 **Chemical Prices:** The chemical suppliers in China are as follows:

a) Bayer
b) BASF
c) Huntsman
d) Zhejiang Chemical Research Institute
e) Huadu Polyurethane Co. Ltd.

4.30 Bayer, BASF and Huntsman are major suppliers in China. Most domestic suppliers are local and much smaller than these large international corporations. All chemical suppliers can provide CFC-11 and 50% reduced systems, while only international suppliers and leading domestic suppliers can provide hydrocarbon, water blown, and HCFC-141b systems.

F. PHASEOUT ACTIONS

4.31 Phaseout actions will include the following:

a) Control supply of CFC-11 by implementing CFC production sector plan and ODS import license system;
b) Ban CFC-11 consumption in the PU foam sector by the end of 2009;
c) Control consumption by implementing phaseout projects;
d) Formulate and promulgate policies to ensure the implementation of the sector plan;
e) Conduct training and public awareness campaigns to promote substitute technologies and encourage enterprises to actively participate in phaseout activities;
f) Provide technical assistance to enterprises for selection of substitute chemicals, formulation and substitute technology;
g) Set up an effective enforcement and supervision system including introduction of a management information system to ensure monitoring and enforcement of phaseout plans;
h) Promote research and development of substitutes and substitute technologies, and
i) Formulate technical norms and safety standards of substitute and alternative technologies.
j) A phased approach will be used to implement the PU Foam Sector Plan. Phaseout actions will start after approval and end by January 1, 2010 as described in the Action Plan (Chapter VIII).

V. POLICIES

A. INTRODUCTION

5.1 Enterprises in the foam sector face several operating challenges which limit their willingness to phase out CFC on a voluntary basis: lack of readily available and low cost substitute technologies, limited capital resources, and the need to maintain quality, market share and profitability. Even though they can receive some financial assistance from the MLF, many enterprises are still reluctant, or lack motivation, to phase out CFCs because they prefer the familiar existing techniques, and would be averse to the uncertainties and disadvantages of changing technological processes (with potentially higher operating costs, lower product quality, or higher safety and health concerns).

5.2 The Government will therefore establish a policy structure to complement MLF funding to ensure CFC phaseout in the sector, and will promote the transfer and dissemination of suitable substitute technologies, and to provide training for workers. Only by establishing and enforcing policies and regulations, can it influence the activities of enterprises and consumers to participate actively and quickly in PU foam conversion. While the key policy instrument for CFC-11 phaseout in the foam sector will focus on the supply side, by controlling and monitoring the production and import of CFC-11 to ensure that consumption targets are reached, it is also necessary to meet the demand for foaming agent and maintain growth in the foam sector by ensuring supply of alternatives technology and substitutes.

B. POLICY OBJECTIVES

5.3 The objectives of the phaseout policies are to achieve the following:

a) Ensure that the consumption of CFC-11 in the foam sector is reduced as scheduled;

b) Provide incentives for enterprises to phaseout CFC-11 and adopt environmentally benign substitute technologies;

c) Ensure the phaseout target of CFC-11 consumption in the foam sector is achieved according to schedule;

d) Encourage the propagation of low cost, technically suitable substitutes to replace CFC-11 based blowing agents;

e) Promote the development and dissemination of substitute technology;

f) Encourage consolidation and regrouping of enterprises; and

g) Ensure that the growth of the foam sector is not affected by meeting the phaseout targets.

C. POLICY DESIGN INPUTS

5.4 The following factors are relevant for a policy framework for the foam sector:

a) The law for prevention and control of air pollution issued on April 29, 2000;
b) The specific Chinese situation, taking into account the characteristics of the foam sector, such as large numbers of geographically scattered enterprises, demands for foam production, etc.;
c) The framework of policies for ODS phaseout in the Country Program;
d) The need to maintain continuity and consistency of these policies with the existing policy and regulation system;
e) Ensuring feasibility of the policies, as also continued supervision and management; and
f) Economic efficiency and fairness.

D. DESCRIPTION OF POLICY INSTRUMENTS

Table 5.1:Policy Framework for ODS Foam Sector

Objective	Policy	Timetable	
		Issue date	Effectiveness date
Control supply of CFC	Ban: Circular on bans of establishment of new production sites for production and consumption of ODS	November , 1997	January 1, 1998
	Quota system: Notice on the implementation of CFC production quota system.	1999	1999
	Import & export license system: Notice of management of import and export of ODS	January, 2000	April, 2000
Control consumption of CFC	Formulation of product standards and technical norms	2004	2004
	Final ban: Ban of CFC-11 consumption in foam sector	January, 2007	January, 2010
Encourage phaseout activities on a voluntary basis	Bidding system	After sector plan approval	after sector plan approval
Guarantee safety and health with substitute technology	Safety and health regulations for using flammable substances as blowing agent	2002	2003
Encourage complete phaseout in the specific regions	Regional Policies	2004	2004
Encourage selection of environmentally friendly substitute technology	Promotion of environmentally friendly substitute technology	Through the project	

5.5 **Circular on bans of establishment of new production sites for production and consumption of ODS** In November 1997, SEPA, SPC, SETC and ICA issued a ban on new ODS

production facilities. The ban requires (a) all regions not to build, enlarge or renovate ODS-based production facilities, (b) environmental bureaus not to approve environmental impact assessment reports for these projects, and (c) governmental planning, and economic and trade administrations at all levels not to approve these production facilities to be set up or put in use.

5.6 **Production quota system:** A tradable production quota system has been adopted for the CFC production sector. Annual ODS production quotas are issued to ODS producers, and are reduced annually based on the CFC production sector plan. The system will effectively reduce the uncertainty in implementing this sector plan. The shortage of CFC supply will also encourage the move to use of substitutes and alternative technology .

5.7 **Import & export license system :** A notice on controlling import and export of ODS was issued and entered into force in April 2000. The regulation requires ODS import and export activities to be registered. Annual import is controlled by a national import quota which is determined every year. Combined with the production quota, the management of ODS import and export effectively regulates the national supply of CFCs and encourages the development and production of substitutes.

5.8 **Product standards and technical norms with substitute technology :** New product standards and technical norms will be promulgated to guarantee the quality of the products manufactured with substitute technology. New standards will also prevent more CFC-based products from entering the market and will promote the application of substitute technology.

5.9 **Safety regulations for using flammable substitutes as blowing agent:** As some substitutes are flammable, safety regulations will be promulgated to prevent fire accidents and guarantee the safety of workers.

5.10 **Promotion of environmentally friendly substitute technology:** China will promote the selection of LCD technology for the phaseout of ODS in the flexible foam sub-sector, as LCD is by far the most environmentally-friendly, safe and cost-effective substitute technology. Because of the negative health implications, the government will not encourage use of MC technology in the sector plan, and will promote use of substitutes (such as VPF) where feasible.

5.11 **Regional policies:** Each region will be encouraged to promulgate its own ban on CFC-11 consumption in the foam sector ahead of phaseout schedule based on its own situation . Regrouping and consolidation of enterprises in the region will be encouraged.

5.12 **Ban of consumption of CFC-11:** A ban on CFC-11 consumption will be promulgated by January 2007, and CFC-11 use in the foam sector will be banned from January 1, 2010.

VI. INCREMENTAL COSTS ANALYSIS

A. GENERAL PRINCIPLES

6.1 The incremental costs for the PU foam sector have been calculated using the following approach:

a) Calculate the remaining eligible consumption of CFC-11 in the sector;
b) using MLF guidelines, calculate the incremental conversion costs of the 356 eligible enterprises identified in the survey, according to the three sub-sectors (rigid, flexible and integral skin);
c) calculate the phaseout costs ($ per kilogram) of each sub-sector;
d) compare these costs with the sub-sector thresholds under MLF guidelines, and use the lower of the two costs in each case to establish the weighted phaseout cost per kilogram for the sector as a whole;
e) used the weighted average cost and the eligible consumption in 1999, adjusted for 3% annual growth and 2.5% annual inflation rate, to calculate the total incremental phaseout costs for the sector.

6.2 The costs calculation is based on information on the total number of CFC consuming PU foam enterprises for which detailed baseline information has been collected (about half of all CFC consuming PU foam enterprises in China); and these costs have been extrapolated for the remaining eligible enterprises, for which either incomplete questionnaires were received or which did not respond at all.

Table 6.1 Number of CFC-11 PU foam enterprises

Total number of enterprises	~1,115
Of which:	
Already funded by MLF	167
Enterprises visited in 1999/2000 in the surveys conducted for the sector plan	408
(rigid foam)	(179)
(flexible foam)	(225)
(integral skin)	(4)
Proposed UNIDO project	8

6.3 **Chemical Prices Used for IOC Calculation**. The chemical prices used for calculating IOC were derived from the following:

a) The prices used in the latest projects approved by ExCom;
b) Price information in completed projects; and
c) Current prices obtained from the market.

Table 6.2 Chemical Prices used in the Sector Plan

Blowing agents (US$/Kg)					
Application	CFC-11	HCFC-141	C-Cyclopentane	LCD	MCl
Price	1.27	1.63	1.00	0.15	0.85
Polyols and other chemicals ($/Kg)					
Application	CFC polyol	HCFC polyol	Cyclopentane polyol	Water blown, integral skin foam	
Polyols	1.33	2.00	1.70	2.10 (before)	2.40 (after)
MDI	1.43	1.43	1.43	US$ 1.70	US$ 1.70

B. FLEXIBLE FOAM SUB-SECTOR

Table 6.3 Basic Data for Flexible Foam Subsector Identified Enterprises

	Number of enterprises	Number of eligible equipment	Eligible consumption (MT)
Identified eligible enterprises	**200**	**214**	**5,341**
Continuous foam enterprises	**109**	**123**	**5,246**
Medium-size-I	60	68	3,914
SME continuous	49	55	1,332
Medium-size II	(28)	(31)	(987)
Small size	(21)	(24)	(345)
Box foam small enterprises	**91**	**91**	**95**

6.4 **Conversion to LCD technology for continuous flexible foam**. LCD has been selected as the choice of technology for continuous flexible foam. Detailed baseline information has been collected from 109 companies through surveys undertaken in 1999 to 2000. The number of production lines to be converted is based on a review of previously MLF funded flexible foam projects[3] and their location, the need for national coverage taking into account the normal regional coverage of a LCD plant, and a minimum CFC-11 consumption per enterprise.

6.5 All the 109 enterprises are in operation. Baseline information regarding existing production facilities is available. The number of employees in the 109 enterprises is on an average 30 to 50 employees per enterprise. A typical flexible foam enterprise in China has a production of between 1,000 tons to 2,000 tons foam annually (break even production is around 600 MT). Due to transportation costs, enterprises normally have a coverage of between 100 to

[3] 41 flexible foam projects have been approved before the sector plan. During the period 1992 to 1997 only MC projects were funded. From 1998, all continuous flexible foam projects has been approved for LCD technology. Of the 41 projects approved, 23 propose conversion to LCD technology.

300 km, depending on location and demand. As development and growth has mainly been in the eastern provinces, the majority of the plants are located in those provinces.

6.6 Funding for conversion of 89 lines is requested in the sector plan. The remaining enterprises will either be closed or convert at their own costs or merged with other enterprises. Industrial rationalization might take place on a provincial level, based on arrangements between enterprises themselves.

6.7 **Methylene Chloride:** As described in Chapter IV, MC is not the preferred technology for box foam producers. However, as it is the least cost solution, it is used for calculating incremental costs in the sector. The conversion costs are provided below.

Table 6.4 Conversion Costs to MC technology

Incremental retrofitting costs per CFC –11 line conversion to MC technology	
Incremental capital costs	US$20,000
Technology, trials, and training	10,000
Technology transfer	0
Total	US$30,000

C. RIGID FOAM SUB-SECTOR

Table 6.5 Basic Data and Assumptions for Rigid Foam Sub-sector Identified enterprises

		Enterprises	**Eligible equipment sets**	**Eligible consumption (MT)**
Cyclopentane technology	Large	18	57	1,011
HCFC-141b	Large	37	118	2,078
"	Medium	72	237	1,313
"	Small	25	49	108
"	**Total**	**152**	**461**	**4,510**

6.8 Rigid foam is produced by a large number of companies of various sizes spread all over China. 61 projects for 113 enterprises have so far been funded by the MLF. The main products include pipe, panels, refrigeration equipment, cold storage, construction insulation, and packing materials. The various products set specific requirements for the foaming equipment. In general, low pressure equipment can be used for products without no insulation performance requirements. High pressure equipment must be used for products where insulation performance is essential.

6.9 Based on the survey, the distribution between the three main categories of products are:

Enterprises for which detailed information were obtained		**179**
Of which –	spray foam applications	116
	Insulation for piping	80
	Insulation panels, boards, refrigeration units	59

(Some enterprises have more than one category of products.)

6.10 **Density increase.** The OORG report on density increase, (UNEP/Ozl.Pro/ExCom/31/61 read with Decision 31/44) is used for determining the density increases necessary to maintain product quality. The density increase does not address insulation performance. Based on weighted core density of baseline foam products and OORG density report, the following percentages in density increase are used:

	Panel	Pipe	Spray foam
Baseline foam density (kg/m3)	40-45	30-33	30-33
Density increase in 1st year	3%	6%	6 %
Density increase in 2nd year	0%	3%	3%

6.11 The replacement technologies selected by China are cyclopentane and HCFC-141b. Among all the identified enterprises, one third of the large size enterprises will select cyclopentane technology and the rest will select HCFC-141b technology.

6.12 **Cyclopentane**. Cyclopentane is a flammable substitute which can only be used in production facilities where the necessary safety measures can be taken, and the equipment needs to be suitable for the use of cyclopentane. Existing domestic-made dispensers cannot be retrofitted for safe use of cyclopentane, but imported dispensers can normally be retrofitted. Based on the ExCom decision on technical upgrades, the MLF will only pay retrofitting costs to China for all dispensers when converted to the use of cyclopentane. The retrofitting cost is about $80,000 per high pressure foam dispenser. Hence, China will have to pay the additional costs for enterprises converting to cyclopentane instead of HCFC-141b. Incremental costs calculation is based on the ExCom guidelines.

6.13 Based on a review of the enterprise information collected, 18 companies (with a total consumption of 1,011 MT) of the 55 large companies presently producing insulation panels or refrigeration cabinets will convert to cyclopentane. It is expected that some enterprises could merge as part of the conversion, while other might be closed and their production be transferred to the enterprises which have selected cyclopentane for their panel producers.

6.14 The incremental capital costs for cyclopentane technology for rigid insulation panel & cabinet insulation and pipe per enterprise are based on the following costs:

Equipment cost	US$341,000 (with 10% contingency to the base cost)
Trials and training	16,000
Technology transfer	10,000
Total per enterprise	367,000

The distribution of different foam products in foam consumption to be converted to cyclopentane foam is 40% pipe and 60% panel.

6.15 The incremental operating costs are based on chemical prices presently used and typical formulations for cyclopentane blown for panel and pipe production. The incremental operating costs per kg cyclopentane blown foam is calculated as US$0.14/kg foam.

Table 6.6 Incremental operating costs for cyclopentane blown foam

	CFC blown foam			Cyclopentane blown foam		
Chemicals	**Parts**	**$/kg**	**Unit costs**	**Parts**	**$/kg**	**Unit costs**
Polyols	100	1.33	0.50	100	1.70	0.73
Blowing agent	33	1.27	0.16	17.16	1.00	0.07
MDI	133	1.43	0.72	117	1.43	0.71
Total			1.37			1.51

6.16 **HCFC-141b**. The capital conversion costs will include replacement of domestic made spray foam machines and retrofitting of imported spray foam machines. The information from two recently approved foam umbrella projects serve as the basis for the costs calculation.

6.17 The incremental capital costs for HCFC 141b technology will depend on size of enterprises and are assumed to be in the range of :

Equipment cost for 141b foam dispensers (US$)	
Imported	15,000
Domestic	40,000
Equipment cost for 141b spray foam unit (US$)	
Imported	8,000
Domestic	18,000
Trials, training and technology transfer	26,000/18,000/10,000 (large/medium/small)

6.18 The incremental operating costs are based on chemical prices presently used and typical formulations for HCFC-141b blown foam for panel production. The incremental operating costs per kg foam is calculated as US$ 0.31/kg foam.

Table 6.7 Incremental operating costs per kg HCFC-141b blown foam

	CFC blown foam			HCFC-141b blown foam		
Chemicals	Parts	$/kg	Unit costs	Parts	$/kg	Unit costs
Polyols	100	1.33	0.50	100	2.00	0.81
Blowing agent	33	1.27	0.16	22	1.63	0.15
MDI	133	1.43	0.72	125	1.43	0.72
Total			1.37			1.68

6.19 Based on these assumptions, the incremental costs in converting to HCFC 141b for identified enterprises are shown below:

Table 6.8: HCFC-141b Conversion Costs for Identified Enterprises

	No of enterprises	Incremental equipment Costs	Trials, technology transfer, training	IOCs	Total Costs
Large	37	3,168,007	962,000	9,523,339	13,653,346
Medium	72	5,337,209	1,296,000	6,014,499	12,647,708
Small	25	1,260,600	250,000	490,138	2,000,738
Total	**134**	**9,765,815**	**2,508,000**	**16,027,976**	**28,301,791**

D. INTEGRAL SKIN FOAM SUB-SECTOR

Table 6.9 Basic data for Integral Skin Sub-sector

	Number of enterprises	Number of eligible equipment	Eligible consumption (MT)
Identified eligible enterprises	4	4	34
Large size	0	0	0
Medium size	0	0	0
Small size	4	4	34

6.20 Most integral skin foam producers have either been covered by previous projects, converted at their own costs or will have to convert at their own costs. The technology choice, which is endorsed by the State Economic & Trade Commission and for which experience is available in China, is water blown integral skin foam.

E. KEY INPUTS FOR COSTS CALCULATION

6.21 The key inputs for the incremental costs calculation include:

a) Eligible consumption by sub-sectors (Table 3.2-3.5);
b) Forecast for production, consumption, import and export of CFC-11 (Table 4.1);
c) Assumptions for incremental costs calculation (Annex I); and
d) Detailed phaseout costs for each subsector (Annex I).

Table 6.10 Key Input for Costs Calculation

Base year = 1999	
Identified eligible consumption for PU rigid (MT ODP)	**4,510**
Of which: large and medium rigid	4,402
small PU rigid	108
Phaseout cost per unit to MLF for PU rigid (US$/kg ODP)	7.83
Real Cost for PU rigid phaseout (US$/kg ODP)	8.02
Identified eligible consumption for PU flexible (MTs ODP)	**5,341**
Of which: Medium-I size PU flexible	3,914
Medium-II size PU flexible	987
SME PU flexible	440
Phaseout cost per unit to MLF for PU flexible (US$/kg ODP)	6.23
Real Cost for PU flexible phaseout (US$/kg ODP)	9.84
Identified eligible consumption for PU integral skin (tons ODP)	**34**
Phaseout cost per unit to MLF for integral skin (US$/kg ODP)	6.07
Real Cost for integral skin phaseout (US$/kg ODP)	6.07
Unidentified eligible CFC consumption by PU enterprises	**766**
Total eligible residual consumption in the PU sector plan	**10,651**
Add ineligible residual consumption to be phaseout in the PU sector plan	1,859
Total residual consumption to be phaseout in the PU sector plan	**12,510**
Weighted phaseout cost per unit to MLF for PU foam sector (US$/kg ODP)	**6.96**
Real Cost for PU foam phaseout (US$/kg ODP)	9.10
Based on residual consumption in 1999 (10,651) with 3% growth	
Total eligible residual consumption in the PU sector plan	**12,071**
Add ineligible residual consumption to be phaseout in the PU sector plan	2,500
Total residual consumption to be phaseout in the PU sector plan	**14,571**

6.22 The residual consumption of CFC-11 is estimated to increase at 3% per year for existing enterprises without phaseout projects.

6.23 Annex I is a summary of incremental conversion costs of 356 identified enterprises calculated based on MLF guidelines. The actual costs of rigid and flexible foam sub-sectors are much higher than MLF thresholds for these two sectors. The Incremental costs of the PU foam sector are based on the thresholds of rigid and flexible foam sub-sectors and the actual cost effectiveness of integral skin foam sub-sector to calculate weighted average phaseout costs per kilogram. The weighted average phaseout cost of US$6.96/kg is used to calculate the total requested incremental costs of the PU foam sector.

Table 6.11: Summary of Incremental Costs of Eligible Consumption by Sub-Sectors

	Identified Eligible Consumption (MT) – Base year = 1999	Incremental Capital costs (US$)	Incremental Operating costs (US$)	Total Incremental costs (US$)	Phaseout costs per kilogram calculated for 356 enterprises (US$/kg)	MLF threshold (US$/kg)	Phaseout costs per kilogram in sector plan
Rigid foam	4,510	18,879,800	18,303,236	37,183,036	8.24	7.83	7.83
Flexible foam	5,341	57,024,000	(4,450,000)	52,574,000	9.84	6.23	6.23
Integral foam	34	123,600	82,724	206,324	6.07	16.83	6.07
	9,885	76,027,400	13,935,959	89,963,359	**9.10**		**6.96**

6.24 Assumptions used in the cost model are:

a) 1999 is the baseline year;
b) prices of raw materials are assumed to remain constant over time;
c) inflation rate is 2.5% per year after 2000;
d) consumption growth rate is 3% for existing enterprises which have no phaseout projects;
e) 10% contingency is used for all incremental equipment costs;
f) any individual phase out activity will be completed within three years (if target approved in 2001, 50% would be completed in 2003 and 50% in 2004);
g) cost information for substitute technologies is shown in above sections; and
h) incremental costs of other technical assistance.

F. CALCULATION METHODOLOGY

6.25 **Incremental costs calculation.** Incremental costs (IC) for CFC-11 phaseout in PU foam sector are based on its annual phaseout eligible amount and weighted average phaseout cost per kg for sector plan.

6.26 **Incremental Costs for technical assistance** activities include the following:

a) technical support to the development of phaseout policies;
b) technical support to the development of new standards;
c) training and promotion of public awareness; and
d) incremental cost of Technical Support System.

G. TOTAL INCREMENTAL COSTS

Table 6.12 Incremental Costs for CFC-11 Phaseout in PU Foam Sector (US$ 1,000)

	Phaseout costs under project by project to China based on ExCom Guidelines	Phaseout costs calculated by weighted average phaseout cost per kg
Replacement of CFC-11 for PU Foam users	114,200	91,100
Adjustment for HCFC141b consumption	-2,400	-2,400
Sub-total	111,800	88,700
Technical Assistance	3,500	3,500
Incremental costs for this sector plan	115,300	
Total funding request for the sector		**92,200**

[1/] Assuming there are 10% saving due to group procurement and other measures under the sector plan.

6.27 A schedule for phasing out CFC-11 is presented in Chapter VIII. The real incremental phaseout cost to China calculated based on MLF guidelines is US$115,300,000, which is calculated based on relevant ExCom guidelines (summarized above). Considering the MLF thresholds, The funding request for phaseout of CFC-11 in the entire PU foam sector is adjusted to account for the residual net ODP consumption resulting from HCFC-141b applications. The adjusted total funding request is US$92,200,000

Table 6.13 Summary of general principles applied in establishing incremental costs

Issues	Comments/reference	Standard cost/adjustment
Conversion of continuous slabs flexible foam conversion to LCD technology.	Out of the 109 enterprises eligible for funding, conversion costs for 89 lines are requested. The average CFC consumption per line is 70 MT CFC-11 /line. There will be some associated costs related to closure of enterprises.	
Conversion of box foaming flexible foam to VPF technology	China is not supporting the use of MC because of safety issues, however because of the high costs of VPF, the funding request is based on the least costs option of VPF and MC. Once implementation begins, China will use some VPF applications. It is recognized that some small box foaming enterprises will continue using MC. However, the smaller box foamers are using MC in an unsafe and unacceptable manner. The calculation of funding is based on the conversion costs of 91 enterprises for which detailed information was obtained.	
Cyclopentane conversion	The use of cyclopentane requires HP foam dispensers. It is assumed that the bigger companies that will be selected already have HP dispensers. In accordance with ExCom decisions, only retrofitting costs will be paid for foaming equipment when converting to cyclopentane.	Typical costs for a dispenser are between $120,000 to $160,000 depending on capacity. However, following the guidelines, standard retrofitting costs for cyclopentane of $80,000 per dispenser is applied in all cases.
HCFC-141b spray foam equipment costs	The principles applied to recent approved foam umbrella projects (31st meeting) are applied; i.e. retrofitting costs of imported spray foam equipment and replacement costs domestic made spray foam equipment.	US$ 18,000 for a new spray foam machine and US$ 8,000 as retrofitting costs
Insulation piping foaming	Insulation performance requirements: Equipment requirements: HP Density increase: Y1: 6% Y2: 3% IOC per kg foam: US$ 0.31	
Insulation spray foam	Insulation performance requirements: Equipment requirements: HP Density increase: Y1: 6% Y2: 3% IOC per kg foam: US$ 0.31	
Insulation panels producers	Insulation performance requirements: Density increase: Y1: 3% Y2: 0% IOC per kg foam: US$ 0.31	
Replacement of LP Foam Dispensers:	Retrofitting of HP foaming equipment is possible, but replacement of LP foam equipment is essential where insulation performance is the key requirement.	Replacement costs of LP dispensers are at an average cost of $40,000 each.

Capacity established after July 1995	Only capacity established before 1995 is funded. In cases where equipment might have been replaced after July 1995, funding are only requested for capacity installed before July 1995. General principles for incremental costs for replacing/retrofitting foam equipment is applied in the costs calculation.	No request for funding for enterprises and for additional capacity installed after July 1995.
Technology transfer	In accordance with the guidelines, the possibility of costs saving through general technology transfer has been applied. It is assumed that a 30% saving can be achieved for the LCD technology. This is included in the costs calculation.	As LCD technology has been established in China and know-how exists, it is assumed that savings can be achieved without impacting on the conversion to LCD.

[1/] First implementation program is for 18 months, from July 2001 to December 2002..

VII. OPERATING MECHANISMS

A. INTRODUCTION

7.1 Upon approval of this sector plan, the Government of China will introduce additional policy measures and take other actions, as described in chapter IV, to achieve a rapid cost-effective CFC-11 phaseout in the foam sector. This chapter explains the funding arrangements, operating mechanisms, and the responsibilities of major institutions involved in implementation of this sector plan.

B. UMBRELLA GRANT AGREEMENT

7.2 China and the World Bank have signed an Umbrella Grant Agreement in December 1997, which sets forth the terms and conditions under which grant resources approved by the ExCom in sector approaches in China would be carried out. This Umbrella Grant Agreement is similar to the umbrella grant agreements under which project-by-project activities are carried out. However, it includes provisions that allow the Bank to disburse funds to China on performance-based indicators in terms of ODS phaseout in sector approaches rather than for procurement of goods and services. The Umbrella Grant Agreement was signed in December 1997 after the Sector Plan for Halon Phaseout in China was approved by ExCom in November 1997.

C. FUNDING ARRANGEMENTS

7.3 MLF Approval. Funds for the Foam Sector Plan would be approved in two steps:

a) Firstly, the Government, through the World Bank, requests that the ExCom consider this overall sector plan and agree to fund the Foam Sector CFC-11 Phaseout with annual advances, as described in Chapters III and VII, provided that China meets the annual phaseout targets referred to in Chapters III and VII. At the same time, China requests ExCom to fund the first Implementation Program covering a period from July 1, 2001 to December 31, 2002. It will be annual programs from 2003 onwards.

b) Secondly, from 2002 on, the Government, through the World Bank, would submit an annual program at the last ExCom meeting each year for funding request. The amount of annual funding request would be consistent with the funding amounts indicated in the overall sector plan. For example, The World Bank, on behalf of the Government, would submit the 2003 annual plan to the ExCom in time to allow for funding approval by November 2002. The ExCom would be asked to release funds by December 2002 at the levels agreed to in this sector plan based on achievement of previous phaseout targets, so that the annual program could start in January 2003. In general, approval of funds would be based on achievement of CFC-11 phaseout targets in the foam sector.

c) Annual plan program funding requests for the years 2004-2006 would be based on achievement of CFC-11 phaseout targets for the previous years and the semi-annual

progress report for the current year. For example, 2004 funds would be approved based on 2002 phaseout results and the 2003 semi-annual progress report, and so on.

7.4 In the unlikely event that China were to fail to achieve phaseout targets for a given year (that is CFC-11 consumption in the foam sector exceeds the target, or contracts signed less than the phaseout target for the year), the Bank and China would agree on remedial actions. New funding requests to the ExCom would go forward only after phaseout targets had been met.

7.5 By the time any over-consumption for a previous year is confirmed, the current year's Annual Program would be most likely having already been founded and be underway. Thus, the proposed approach to remedial action is to bring the program back on track by the end of the current year. For example, if over-consumption occurred in 2002, remedial actions would ensure that, by the end of 2003, cumulative CFC 11 consumption for the two years, 2002 and 2003 would not exceed the combined targets for the two years. The remedial actions taken to assure this result would be submitted along with the next year's funding request (refer to 2004 in the above-mentioned example). The ExCom would therefore be in a position to decide either to release funds or condition release funds for the next year's Annual Program upon accepted evidence showing that the remedial actions were successful and the cumulative consumption of the previous two years did not exceed the combined targets. This approach to remedial action allows the program to maintain momentum and keeps the phaseout schedule on track even if difficulties arise in a particular year.

7.6 If the program is still not back on track within two years, continued funding of the program could be based on a reduced level of compensation. Under this plan, grant funds would be released for Annual Programs and disbursed through the World Bank to China to achieve specific phaseout targets. Therefore, even if delays are expected in any given year, the Bank, on behalf of the Government will still submit request for funding approval for the next calendar year for phaseout targets in the following year. However, if it is proved that a delay is persistent and the phaseout targets could not be achieved within the schedule set in the approved Foam Sector Plan , funds proportional to phaseout shortfall would be returned to the Multilateral Fund.

7.7 Annual Program would contain the following sections:

a) sector phaseout schedule;
b) status of all activities of previous year(s) and any agreed remedial actions for the current year (not required for the first implementation program covering July 2001 to December 2002).
c) objectives of following year's Annual Program – phaseout targets and funding requirements for activities in the following year[2];

[2] Total grant funding for each year would be agreed along with this sector plan proposal. However, China would have flexibility in each Annual Program to allocate funds within enterprise-level or TA activities to achieve phaseout targets.

d) description of activities in the following year – enterprise level activities, policies to be implemented and technical assistance activities; and
e) performance indicators of the annual program.

7.8 The World Bank would approve the technical assistance consistent with the Annual Program based on the agreed TOR of TA (including the funding level of TA) in that year's Annual Program. Procurement of consultant services and equipment will be based on agreed Bank procurement procedures for all TA activities.

D. DISBURSEMENT MECHANISM

7.9 **Multilateral Fund (MLF) disbursement to the World Bank** --The MLF will deposit the agreed annual funding to World Bank shortly after ExCom approval of the Annual Program.

7.10 **World Bank disbursement to China** -- There would be four disbursements into the ODS Phaseout Account at SEPA for each Annual Program. The Government would be allowed to request these four disbursements at any time during the year, provided that the disbursement conditions have been met. In any particular year, disbursement to China will start only when the Bank receives grants for that annual program from the MLF. Disbursement conditions and amounts to be disbursed are as follows:

a) ***First disbursement*** – funds for technical assistance and management fees.
Condition – Annual Program has been approved by the ExCom.

b) ***Second disbursement*** – 30% of funds allocated for enterprise activities.
Conditions –
   i) 30% of all reduction contracts that covering target phaseout amount of the current year's Annual Program have been signed by government with enterprises;
   ii) Progress report on the sector plan implementation is satisfactory to the Bank; and
   iii) Any other conditions as specified in the current Annual Program.

c) ***third disbursement*** – 50% of funds allocated to enterprise activities.
Conditions –
   i) 100% of all reduction contracts that covering target phaseout amount and TA contracts of the current year's Annual Program have been signed; The government reports the actual consumption does not exceed the consumption target set for the preceding year (not applicable to the first implementation program);
   ii) A list of all production facilities disposed in the previous year should be provided to the Bank. This list would contain all information related to disposal and sufficient indication that consumption phaseout in the preceding year has been achieved (not applicable to the first implementation program);

iii) Progress report on the sector plan implementation is satisfactory to the Bank; and
iv) Any other conditions as specified in the current Annual Program.

d) ***Fourth disbursement*** – 20% of funds allocated to enterprise activities.
Conditions –
i) the CFC-11 consumption of the previous year in foam sector does not exceed the set target (a 5% allowance of consumption target would be permitted. The difference would be remedied in next year's Annual Program);
ii) verification of the disposal certification and project completion reports of completed projects which account for CFC 11 consumption phaseout target set for the previous year;
iii) progress report on sector plan implementation is satisfactory to the Bank; and
iv) Any other conditions as specified in the current Annual Program.

7.11 If there is any problems found during implementation stage, either by reviewing the progress report or during supervision missions, the Bank will suspend further disbursement to China. Disbursement will resume only after China and the Bank agree on remedial actions to rectify implementation deficiencies.

7.12 **Chinese government allocation of funds to CFC-11 consuming foam enterprises for phaseout activities.** Most of the grant fund will be allocated to enterprises through a bidding process. The first bidding will be conducted at the end of 2001, after the ExCom approval of the sector plan and the first implementation program. Preparation of bidding in subsequent years will start in the second half of each year and would be concluded after ExCom approval of the following year's Annual Program and funding level. After the bidding process, bid winners would sign ODS reduction contracts with the SEPAt. The contracts will stipulate, among others,: (a) the agreed CFC phaseout date; (b) the disposal equipment list and agreed disposal dates. Some fund will be allocated to small enterprises through a voucher system. This mechanism is expected to be used after the first few years of implementation of the sector plan. Details will be developed in the next few years and will be incorporated into the Project Implementation Manual.

7.13 **Disbursement from SEPA 's ODS phaseout account to grant recipients**. Grant funds would be disbursed directly from the ODS phaseout account to recipients based on terms and conditions (a) in the "ODS phaseout contracts" for enterprise activities, and (b) in the consultant or training contracts for technical assistance activities. For example:

a) Conversion project – According to CFC-11 phaseout contracts, disbursement will be made on procurement-based indicators and payment schedules in the procurement contracts;
b) Closure projects – Disbursement will be based on agreed closure plans and contracts; and
c) Technical assistance activities – grant funds would be disbursed to consulting firms or

training institutes based on disbursement conditions agreed in the TOR and contracts.

7.14 For any performance delays, SEPA would be advised to take immediate necessary actions and agreed with the Bank on a remedial action plan. Disbursement would proceed only after official confirmation of progress in annual program implementation and national CFC-11 phaseout and considered to be satisfactory to the Bank.

E. MANAGEMENT AND COORDINATION

7.15 This Sector Plan for CFC-11 Phaseout in Foam Sector will be executed by the Government of China. PMO and the foam working group will manage and coordinate execution of each year's Annual Program. In addition, SEPA will select a qualified firm[3] to help manage day-to-day activities at enterprise level. The World Bank will supervise overall implementation of this Sector Plan, replenish the local project bank account, report implementation progress to the ExCom and submit future funding requests to the ExCom.

7.16 The national execution management and coordination functions are as follows:

a) Project Management Office (PMO) is an administrative office under the State Environmental Protection Administration (SEPA) with overall responsibility for implementation of China's ODS Phaseout Country Program including the Foam PU Sector Plan. In December 1998, the foam sector team was established within PMO comprised of officials from PMO, the CPPIA, and domestic experts. With the support of the PMO, the foam sector team is in charge of the following work related to the Foam PU Sector Plan and foam sector phaseout:
   i) establish a monitoring and reporting system including an MIS to track CFC 11 phaseout and implementation of Annual Programs and all related activities to CFC-11 phaseout in the foam PU sector;
   ii) report implementation status of Annual Program and sector plan to the World Bank quarterly and as requested;
   iii) review bid winner selection;
   iv) authorize disbursement requests to enterprises as prepared by the DIA;
   v) supervise consultant firms in all TA activities jointly with the CPPIA;
   vi) verify completed CFC-11 phaseout activities at enterprise-level, oversee verification process and preparation of financial audit; develop, implement and enforce CFC-11 phaseout policies in the foam PU sector with all relevant authorities; and
   vii) develop monitoring indicators to verify and report on the sector consumption phaseout.

b) Local environmental protection bureaus - On a day-to-day basis, the local environmental protection bureaus will, entrusted by SEPA/PMO, conduct random

[3] SEPA will sign a contract with the firm after ExCom approval of the first implementation Program.

visits to beneficiary enterprises to ensure CFC-11 consumption phaseout; and enforce policy implementation.

c) Domestic Implementing Agent (DIA) – A DIA[4] will be selected by SEPA through a competitive bidding process for the foam PU sector. Under the guidance of PMO, DIA will supervise all day-to-day enterprise activities, including:
   i) conduct annual bid process and evaluate bid documents to select the lowest bid as winners governed by pre-determined bidding principles;
   ii) supervise implementation of enterprise activities selected through the bidding process;
   iii) supervise implementation of the voucher system;
   iv) review disbursement requests from beneficiary enterprises, and prepare disbursement requests to PMO for authorization;
   v) maintain the MIS for the entire sector;
   vi) report regularly progress all enterprise activities to PMO; and
   vii) alert PMO to problems identified during supervision of enterprise activities; and
   viii) prepare semi-annual progress report and all PCRs on enterprise activities (closures and conversions)

F. MONITORING AND EVALUATION

7.17 PMO is the core organization for monitoring implementation of Annual Programs for CFC-11 consumption phaseout in the foam PU sector and reporting to the World Bank. DIA will supervise enterprise activities and submit written progress report to PMO four times a year on implementation status or as necessary. PMO will track policy enforcement and technical assistance implementation. PMO will submit progress reports to the Bank twice a year and as necessary. Implementation status of all activities in annual programs and sector CFC 11 phaseout will be reported to ExCom once a year during preparation of following year's annual program.

7.18 Verification. The Bank will conduct an independent verification annually to verify CFC-11 consumption level. The Bank will supervise the implementation of Annual Programs including spot checks of the records of on-going projects and random factory visits.

7.19 Audit. There will a annual financial audit of the ODS Phaseout Account at SEPA, conducted by an independent audit agency found satisfactory to the Bank.

[4] SEPA will select a DIA from a shortlist of consulting firms agreed with the Bank. All the firms should have experience of financial and project management.

VIII. ACTION PLAN

Line		Base-line (1999)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Phaseout targets and project impacts (MT)												
1.	Domestic consumption target	19,162	14212	14143	13830	11666	9646	7164	3821	3553	102	0
2.	Phaseout targets for the sector plan		2,000 (target for 18 months)		2,000	2,500	2,500	2,500	571	0	0	0
3.	Phaseout impact of previously approved projects		2,241	1,847	1,135	349						
4.	Phaseout impact of Sector Plan		0	0	0	1,000	2,000	2,250	2,500	2,500	1821	0
Funding Request (US$ 000) (Adjusted for $2.4 million from 2004 and 2005 on account of residual HCFC-141b ODP)												
5.	Investment Projects	88,700	14,300		14,600	17,500	18,000	1,9700	4600			
6.	TA	3,500	800		900	800	400	400	200			
7.	Total	92,200	15,100		15,500	18,300	18,400	20,100	4,900			

Explanations: This is a rolling plan where the impact of an annual program is spread over subsequent years. Every annual program will provide detailed progress of all program activities of previous years, including policy implementation, enterprise activities, and technical assistance activities. The following explains lines 1 to 4 in the above table, as well as the composition of each Implementation/Annual program.

1. Line 1 – the domestic consumption target in the foam sector is derived from the following formula:

   Consumption target in foam sector = total available consumption of CFC-11 in the country, minus CFC-11 consumption in all other consumption sectors.

2. **First Implementation Program** (for the remaining months of 2001 and all of 2002): the following activities are 'captured' under this program:

   a. Line 2 -- Phaseout targets for the sector plan: new investment projects contracts with enterprises for phasing out 2,000 MT of CFC-11 to be signed by the end of 2001.

   b. Line 3 -- Phaseout amount of previously approved projects: the phaseout of 2,241

MT in 2001 and 1,847 MT in 2002 from projects approved prior to the Sector plan (in 2000 and earlier), will be completed during this program.

c. Line 4 -- Phaseout amount in sector plan: the phaseout impact of the new contracts (2,500 MT) will be 0 in 2001, and 0 in 2002.

3. **2003 Annual Program**: This will be prepared in mid-2002. It will consist of the following:

a. Line 2 -- Phaseout targets for the sector plan: new investment project contracts with enterprises for phasing out 2,000 MT of CFC-11 to be signed in the first half of year 2003.

b. Line 3 -- Phaseout amount of previously approved projects: the phaseout of 1,135 MT from projects approved prior to the Sector Plan (in 2000 and earlier), will be completed during the year.

c. Line 4 -- Phaseout amount in sector plan: the impact will be 0 in 2003.

d. Verification of the disposal certification of equipment (and , where available, PCRs) accounting for CFC phaseout of 2,241MT (phaseout impact of previously approved projects in 2001 from line 3) to be carried out in 2003 as part of this annual program.

4. **2004 Annual Program**: This will be prepared in mid-2003. It will consist of the following:

a. Line 2 -- Phaseout targets for the sector plan: new investment project contracts with enterprises for phasing out 2,500 MT of CFC-11 to be signed in the first half of 2004.

b. Line 3 -- Phaseout amount of previously approved projects: the phaseout of 349 MT from previously approved projects will be completed this year. At this stage, the impact of all projects approved before the Sector Plan should have been accounted for.

c. Line 4 -- Phaseout amount in sector plan: the phaseout impact will be 1,000 MT from projects contracted in the First Implementation Program (50% of the 2,000 MT of contracts signed).

d. Verification of the disposal certification of equipment (and, where available, PCRs) accounting for CFC phaseout of 1,847 MT (phaseout impact of previously approved projects in 2002 from line 3) to be carried out in 2004 as part of this annual program.

5. **2005 Annual Program**: This will be prepared in mid-2004. It will propose the following:

a. Line 2 -- Phaseout targets for this sector plan: New investment project contracts

with enterprises for phasing out 2,500 MT of CFC-11 to be signed in the first half of 2005.

b. Line 3 – Phaseout amount of previously approved projects will be 0 in 2005.

c. Line 4 – Phaseout amount in sector plan: The phaseout impact of 2,000 MT will include 50% (or 1,000 MT) of the contracts signed in the first implementation program, and 50% (1,000 MT) of the contracts signed in the 2003 Annual Program.

d. Verification of the disposal certification of equipment (and, where available, PCRs) accounting for CFC phaseout of 1,135 MT (phaseout impact of previously approved projects in 2003 from line 3) to be carried out in 2005 as part of this annual program.

6. **2006 Annual Program**: This will be prepared in mid-2005. It will propose the following:

a. Line 2 -- Phaseout targets for this sector plan: New investment project contracts with enterprises for phasing out 2,500 MT of CFC-11 to be signed in the first half of 2006.

b. Line 3 – Phaseout amount of previously approved projects will be 0 in 2006.

c. Line 4 – Phaseout amount in sector plan: The phaseout impact of 2,250 MT will include 50% (or 1,000 MT) of the contracts signed in the 2003 annual program, and 50% (1,250 MT) of the contracts signed in the 2004 Annual Program.

d. Verification of the disposal certification of equipment (and, where available, PCRs) accounting for CFC phaseout of 349 MT (phaseout impact of previously approved projects in 2004 from line 3) and 1,000 MT (phaseout impact in 2004 from the sector plan, line 4) to be carried out in 2006 as part of this annual program.

7. **2007 Annual Program**: This will be prepared in mid-2006. It will propose the following:

a. Line 2 -- Phaseout targets for this sector plan: New investment project contracts with enterprises for phasing out 571 MT of CFC-11 to be signed in the first half of 2007.

b. Line 3 – Phaseout amount of previously approved projects will be 0 in 2007.

c. Line 4 – Phaseout amount in sector plan: The phaseout impact of 2,500 MT will include 50% (or 1,250 MT) of the contracts signed in the 2004 annual program, and 50% (1,250 MT) of the contracts signed in the 2005 Annual Program.

d. Verification of the disposal certification of equipment (and, where available, PCRs) accounting for CFC phaseout 2,000 MT (phaseout impact in 2005 from the sector plan, line 4) to be carried out in 2007 as part of this annual program.

8. **2008 Annual Program**: This will be prepared in mid-2007 and will have no funding

request. It will propose the following:

a. Line 2 -- Phaseout targets for this sector plan: New investment project contracts with enterprises for phasing out 571 MT of CFC-11 to be signed in the first half of 2008.

b. Line 3 – Phaseout amount of previously approved projects will be 0 in 2008.

c. Line 4 – Phaseout amount in sector plan: The phaseout impact of 2,500 MT will include 50% (or 1,250 MT) of the contracts signed in the 2005 annual program, and 50% (1,250 MT) of the contracts signed in the 2006 Annual Program.

d. Verification of the disposal certification of equipment (and, where available, PCRs) accounting for CFC phaseout 2,250 MT (phaseout impact in 2006 from the sector plan, line 4) to be carried out in 2008 as part of this annual program.

9. **2009 Annual Program**: This will be prepared in mid-2008 and will have no funding request. It will propose the following:

a. Line 2 – There will be no reduction contracts to be signed in 2009.

b. Line 3 – Phaseout amount of previously approved projects will be 0 in 2009.

c. Line 4 – Phaseout amount in sector plan: The phaseout impact of 1,821 MT will include 50% (or 1,250 MT) of the contracts signed in the 2006 annual program, and 100% 571 MT of the contracts signed in the 2008 Annual Program. By 2008, most of the remaining foam PU enterprises are expected to be small enterprises. Their conversions and closures are expected to be completed one after reduction contracts are signed.

d. Verification of the disposal certification of equipment (and, where available, PCRs) accounting for CFC phaseout 2,500 MT (phaseout impact in 2007 from the sector plan, line 4) to be carried out in 2009 as part of this annual program.

e. All PCRs of individual reduction contracts will be completed.

f. Agreement with the World Bank a TOR on the preparation of a PCR for the entire foam sector.

10. **2010 Annual Program.** This will be prepared in mid-2009 and will have no funding request. It will propose the following:

a. Verification of the disposal certification of equipment (and, where available, PCRs) accounting for CFC phaseout 2,500 MT (phaseout impact in 2008 from the sector plan, line 4) to be carried out in 2010 as part of this annual program.

b. Preparatory work to start for the PCR.

11. **2011.** A PCR will be prepared covering all sector plan activities and be submitted to the ExCom during the year.

ANNEX I : CALCULATION OF INCREMENTAL COSTS FOR ELIGIBLE ENTERPRISES IDENTIFIED IN THE SURVEY

TABLE 1: INCREMENTAL COSTS OF ELIGIBLE CONSUMPTION BY SUB-SECTORS

	Identified Eligible Consumption (MT) – Base year = 1999	Incremental Capital costs (US$)	Incremental Operating costs (US$)	Total Incremental costs (US$)	Phaseout costs per kilogram calculated for 356 enterprises (US$/kg)	MLF threshold (US$/kg)	Phaseout costs per kilogram in sector plan
Rigid foam	4,510	18,879,800	18,303,236	37,183,036	8.24	7.83	7.83
Flexible foam	5,341	57,024,000	(4,450,000)	52,574,000	9.84	6.23	6.23
Integral foam	34	123,600	82,724	206,324	6.07	16.83	6.07
	9,885	76,027,400	13,935,959	89,963,359	**9.10**		**6.96**

TABLE 2: BASIC DATA AND ASSUMPTIONS FOR RIGID FOAM

Profile of Enterprises			
	# of enterprises	**# of eligible equipment**	**Eligible consumption (MT)**
Total # of enterprises in the sub-sector	**179**		
Large	59		
Medium	84		
Small	36		
Identified eligible enterprises	**152**	**461**	**4,510**
Large	55	175	3,089
Medium	72	237	1,313
Small	25	49	108
Technology chosen by China for eligible enterprises (estimates)			
Pentane technology (large)	18	57	1,011
HCFC 141b			Among all identified enterprises, one third of large size enterprises will select pentane technology and the rest will select HCFC-141b.
Large	37	118	
Medium	72	237	
Small	25	49	

Density increase Adjustments			
Percentage of density increase: decided based on OORG density report			
Baseline foam consumption = Baseline CFC-11 consumption / percentage of CFC-11 in foam			
	Panel	**Pipe**	**Spray Foam**
Baseline foam density (kg/m3)	40-45	30-33	32-35
Density Increase (1st year)	3%	6%	6%
Density Increase (2nd year)	0%	3%	3%
Distribution of products in foam consumption to be converted to pentane foam	60%	40%	
Distribution of products in foam consumption to be converted to HCFC-141b	20%	40%	40%

Conversion Cost to Pentane Technology	
Unit cost per plant	Unit Cost
C-Pentane Foaming	
Retrofitting cost of HP foam dispenser	80,000
Premixing Station	80,000
Modification of Press	20,000
Nitrogen Generator and Pipelines for Flushing	20,000
Grounding and electrical work	10,000
HC Gas Monitoring System with 6 Sensors	20,000
Ventilation and Exhaustion	30,000
Subtotal	260,000
C-Pentane storage and distribution	
20 m3 double wall tank	25,000
100 m underground double wall pipe and civil works	5,000
Subtotal	30,000
Safety certification	20,000
Total	**310,000**

Conversion cost to HCFC-141b	
Retrofit –imported HP Dispenser	15,000
Replacement – Dispenser	40,000
Retrofit – Spray Foam Unit	8,000
Replacement – Spray Foam Unit	18,000
Trials, Technology Transfer and Training (per plant)	
Large	26,000
Medium	18,000
Small	10,000

TABLE 3: INCREMENTAL COSTS FOR RIGID FOAM

Incremental Capital Costs - Foaming Equipment												
Enterprise size category	Selected technology	No. of Enterprises	No. of Equipment (lines)	Equipment								
				HC Conversion Cost per plant			HCFC-141b Foam Dispenser			HCFC-141b Spray foam unit		
				No. of lines	Unit cost	Total cost	No. of lines	Unit cost	Total cost	No. of lines	Unit cost	Total cost
Large	HC	18	57	18	310,000	5,580,000						
Large	HCFC-141b	37	118				48			70		
Medium	HCFC-141b	72	237				48			189		
Small	HCFC-141b	25	49				17			32		
	Sub-totals	***152***	***461***				***113***			***291***		
Distribution of HCFC-141b enterprises												
Imported Foam Machine (retrofits)							10	15,000	150,000	63	8,000	504,000
Domestic Foam Machine (replacements)							103	40,000	4,120,000	228	18,000	4,104,000
						5,580,000	*113*		**4,270,000**	*291*		**4,608,000**
Total cost of foaming equipment (including 10% contingency)												**15,903,800**

Notes:

1. HC: 18 enterprises with 57 lines will convert to 18 HC lines.
2. HCFC-141b – Large: 37 enterprises with 118 lines will convert to 48 regular and 70 spray foam dispenser lines.
3. HCFC-141b – medium: 72 enterprises with 237 lines will convert to 48 regular and 189 spray foam dispenser lines.
4. HCFC-141b - small: 25 enterprises with 49 lines will convert to 17 regular and 32 spray foam dispenser lines.
5. HCFC-141b: enterprises with imported baseline equipment will receive retrofits costs (10 regular and 63 spray foam dispenser lines) and enterprises with domestic baseline equipment will receive replacement costs (103 regular and 228 spray foam dispenser lines).

Incremental Capital Costs - Trials, Technology Transfer and Training				
	Large	**Medium**	**small**	
Trials	10,000	7000	4000	
Technology Transfer	10,000	7000	4000	
Training	6,000	4000	2000	
Total	26,000	18,000	10,000	**2,976,000**
Number of enterprises	55	72	25	**152**

Incremental Operating Costs – HCFC-141b							
Before Conversion				After Conversion			
Chemicals	Ratio	Price ($/kg)	Cost	Chemicals	Ratio	Price($/kg)	Cost
Polyol	100	1.33	0.50	Polyol System	100	2.00	0.81
CFC-11	33	1.27	0.16	HCFC-141b	22	1.63	0.15
MDI	133	1.43	0.72	MDI	125	1.43	0.72
Unit Cost ($/kg)			1.37	Unit Cost ($/kg)			1.68
Baseline year foam production (kg)			24,703,976	Foam Production (1st year after conversion)			26,037,991
Baseline year foam production (kg)			24,703,976	Foam Production (2nd year after conversion)			25,296,872
Baseline year foam cost ($)			33,907,536	Foam cost (1st year after conversion)			43,712,509
Baseline year foam cost ($)			33,907,536	Foam cost (2nd year after conversion)			42,468,320
Cost Difference Between CFC-11 Foam and HCFC-141b Foam (1st year, discounted at 10%)							8,922,525
Cost Difference Between CFC-11 Foam and HCFC-141b Foam (2nd year, discounted at 10%)							7,105,451
Net Present Value of Incremental Operating Cost for Two Years (10%/yr.)							**16,027,976**

Incremental Operating Costs – Cyclopentane							
Before Conversion				After Conversion			
Chemicals	Ratio	Price ($/kg)	Cost	Chemicals	Ratio	Price($/kg)	Cost
Polyol	100	1.33	0.50	Polyol System	100	1.7	0.69
CFC-11	33	1.27	0.16	C-Pentane	17.16	1	0.07
MDI	133	1.43	0.72	MDI	117	1.43	0.68
Unit Cost ($/kg)			1.37	Unit Cost ($/kg)			1.51
Baseline year foam production (kg)			7,139,357	Foam Production (1st year after conversion)			7,439,210
Baseline year foam production (kg)			7,139,357	Foam Production (2nd year after conversion)			7,225,030
Baseline year foam cost ($)			9,799,152	Foam cost (1st year after conversion)			11,261,432
Baseline year foam cost ($)			9,799,152	Foam cost (2nd year after conversion)			10,937,206
Cost Difference Between CFC-11 Foam and pentane Foam (1st year after conversion using 10% as discount factor)							1,330,675
Cost Difference Between CFC-11 Foam and pentane Foam (2nd year after conversion using 10% as discount factor)							944,585
Net Present Value of Incremental Operating Cost for Two Years (10%/yr.)							**2,275,260**
Total Incremental Operating Costs							**18,303,236**
Total Incremental Capital Costs							**18,879,800**
Total Incremental cost for rigid foam sub-sector							**37,183,036**

TABLE 4: DENSITY ADJUSTMENTS OF INCREMENTAL OPERATING COSTS FOR RIGID FOAM

	Panel	Pipe	Spray	Subtotal (by technology)
HCFC-141b				
Baseline density	**40-45**	**30-33**	**32-35**	
1st year density increase	**3%**	**6%**	**6%**	
2nd year density increase	**0%**	**3%**	**3%**	
1st year IOC by product	1,603,351	3,659,587	3,659,587	
2nd year IOC by product	1,255,862	2,924,794	2,924,794	
Subtotal (by product)	**2,859,213**	**6,584,382**	**6,584,382**	**16,027,976**
Pentane				
Baseline density	**40-45**	**30-33**	**32-35**	
1st year density increase	**3%**	**6%**	na	
2nd year density increase	**0%**	**3%**	na	
1st year IOC by product	727,594	603,081	na	
2nd year IOC by product	502,165	442,420	na	
Subtotal	**1,229,759**	**1,045,500**		**2,275,260**
IOC (by product) of two years	**4,088,972**	**7,629,882**	**6,584,382**	
Total IOC for rigid foam				**18,303,236**

TABLE 5: BASIC DATA AND ASSUMPTIONS FOR FLEXIBLE FOAM

Profile of enterprises				
		Medium sized I	**Medium sized II**	**Small**
Identified eligible Continuous Enterprises	109	60	28	21
Identified Eligible Box Enterprises	91			91
		# of enterprises	**# of eligible equipment**	**Eligible consumption (MT)**
Total identified eligible enterprises		200	214	5,341
Continuous foam				
Medium sized I		60	68	3,914
SME continuous		49	55	1,332
Medium sized II		(28)	(31)	(987)
small		(21)	(24)	(345)
Box foam				
Small		91	91	95
LCD Conversion				
Unit costs per plant				
Item				**Unit Cost**
LCD System				350,000
HP pump system				70,000
LCD Bulk Storage Tank and LCD Refrigeration System				50,000
Building modification				10,000
Subtotal				***480,000***
Cost of trial, technology transfer and training per plant				80,000
Methylene chloride Conversion				
Unit cost per plant				
Item				**Unit Cost**
MC storage tank				2000
MC metering system				2000
Ventilation				7000
MC monitoring system				7000
Safety facilities				2000
Subtotal				***20,000***
Cost of trial, technology transfer and training per plant				10,000
Incremental Operating Costs				
Unit IOC per plant for LCD				-50,000
Unit IOC per plant for MC				0

TABLE 6: COSTS FOR THE FLEXIBLE FOAM SUB-SECTOR

Incremental Capital Costs						
Cost of Foaming Equipment						
Enterprise size category	**Technology selected**	**Enterprises**	**Equipment (# of lines)**	**Equipment (# of lines) selected for replacement**	**Unit cost per plant**	**Total costs**
Medium sized I	LCD	60	68	60	480,000	28,800,000
SMEs continuous	LCD	49	55	29	480,000	13,920,000
Box foam	MC	91	91	91	20,000	1,820,000
Subtotal		200	214	180		***44,540,000***
Total cost of foaming equipment (including 10% contingency)						**48,994,000**
Cost of trials, technology transfer and training for LCD conversion						
		Unit Cost		**No. of Enterprises**		
Trial		15,000				
Technology Transfer		50,000				
Training		15,000				
Subtotal		***80,000***		89		***7,120,000***
Cost of trial, technology transfer and training for MC conversion						
		Unit Cost		**No. of Enterprise**		
Trial		5,000				
Technology Transfer		3,000				
Training		2,000				
Subtotal		***10,000***		91		***910,000***
Incremental Operating Costs						
Number of production lines		**Technology**	**Cost per enterprise**			**Total**
89		LCD	-50,000			-4,450,000
91		MC	0			0
Total incremental Costs						
	Identified Eligible Consumption (MT) in base year	**Incremental capital costs**	**Incremental operation costs**	**Total increment costs**		**Incremental costs per unit project by project (US$kg)**
Medium sized I	3,914	36,480,000	-3,000,000	33,480,000		8.55
SME continuous	1,332	17,632,000	-1,450,000	16,182,000		12.15
Box foam	95	2,912,000	0	2,912,000		30.65
Total	**5,341**	**57,024,000**	**-4,450,000**	**52,574,000**		**9.84**

TABLE 7: ASSUMPTIONS FOR INTEGRAL SKIN SUB-SECTOR

Profile of enterprises			
	Large	**Medium**	**Small**
Identified Enterprises	0	0	4
Eligible enterprises			4
Total Enterprises			4
Number of molds in each factory:			10
Unit cost of equipment			
Item		**Unit Cost**	
Mold modification			500
Heating facility			5,000
In-mold coating machine			3,000
Cost of trial, technology transfer and training per plant:			10,000

TABLE 8: COSTS FOR INTEGRAL SKIN SUB-SECTOR

Incremental Capital Costs												
Cost of Foaming Equipment												
Enterprise size category	**Technology selected**	**No. of Enterprises**	**Equipment (# of lines)**	**Equipment**								
				Mold Modification			Heating Facility			In-mold Coating Unit		
				Amt.	Unit Cost	Cost	Amount	Unit Cost	Cost	Amount	Unit Cost	Cost
Small	Water Blown	4	4	40	500	20,000	4	5,000	20,000	12	3,000	36,000
Subtotal		4	4			***20,000***			***20,000***			***36,000***
Total cost of foaming equipment (including 10% contingency)												**83,600**

Cost of Trial, Technology Transfer and Training				
	Unit Cost	No. of Enterprise		
Trial	4,000			
Technology Transfer	4,000			
Training	2,000			
	10,000	4	**Total cost**	**40,000**
Total Incremental Capital Costs				**123,600**

Incremental Operating Costs							
Before Conversion				After Conversion			
Chemicals	Ratio	Price ($/kg)	Cost	Chemicals	Ratio	Price ($/kg)	Cost
Polyol	100	2.1	1.34	Polyol System	100	2.4	1.69
CFC-11	14	1.27	0.11				
MDI	43	1.7	0.47	MDI	42	1.7	0.50
				In-mold Coating	5	1.5	0.05
				Cleaning Agent	5	0.5	0.02
Unit Cost ($/kg)			1.92	Unit Cost ($/kg)			2.26
Foam Production (kg)			137,030				137,030
Foam Cost ($)			262,609				310,152
Cost Difference Between CFC-11 Foam and Water Blown Foam Per Year							47,542
Net Present Value of Incremental Operating Cost for Two Years (discounted at 10%/yr.)							82,724
Total Cost of Incremental Operating Cost							**82,724**
Incremental cost for Integral Skin foam sub-sector							**206,324**

ANNEX II : COMMENTS OF THE OORG REVIEWER

CHINA - FOAM SECTOR PLAN – OORG REVIEW

GENERAL

The plan covers the phase-out of 9,885 tons of CFC 11 in polyurethane foam in the rigid, flexible and integral skin foam sectors. These sectors include 179, 200 and 4 enterprises respectively. The project excludes phase-out in the refrigeration sector, which will be covered by a separate terminal umbrella project. The plan also excludes the PS/PE sectors.

TECHNOLOGY

The three foam sectors addressed by this plan are rigid foams, flexible foam and integral skin foams. Addressing each in turn, including the proposed technology choices:

Rigid foams

There are a total of 152 enterprises in the rigid foam sector. These enterprises are involved in insulation foam for panels, boards and refrigeration units, pipe insulation and spray foam. The replacement technologies are pentane for the larger enterprises (not for spray foam) and HCFC 141b for the medium and small enterprises and all enterprises involved in spray foam.

Several technologies were considered before the final choices were made. The use of pentane is widely accepted for several rigid foam production processes (not just in Europe!). The main exception is for spray foam where process safety considerations are critically important and have, so far, prevented the use of pentane. There is consideration of this blowing agent for spray foam in the USA but the technology is not used commercially and is unproven. Additionally, because of the safety engineering requirements, pentane is not cost effective for small and medium-sized enterprises. Consequently, its use is only proposed for 18 of the enterprises in this project. HCFC 141b is suitable for all rigid foam production processes and is the most cost effective CFC 11 replacement. In most cases the existing production, especially if the dispenser is from a foreign manufacturer, can be retrofitted to produce foam with HCFC 141b as the blowing agent.

For the 18 enterprises where the use of pentane is proposed the project includes the retrofitting of the current high-pressure dispensers, pre-mixers, pentane storage tanks and appropriate safety engineering measures together with a provision for safety certification. In the cases where the dispenser was locally made and has to be replaced, only the cost to the equivalent of retrofitting will be covered. In the cases of the conversion to HCFC 141b the imported dispensing machines will be retrofitted and the domestic machines will be replaced.

There is also provision for technology transfer, trials and training. These provisions are scaled appropriately for the enterprises in the large, medium and small categories.

In all cases the incremental operating costs include provisions for density changes in line with ExCom Decision 31/44.

Flexible Foams

This sector comprises 109 enterprises manufacturing continuous slabstock foam and 91 enterprises making (discontinuous) box foam. The enterprises making slabstock foam have been subdivided into large, medium and small enterprises.

The technologies proposed are CO_2 (LCD) for the slabstock producers and methylene chloride (MC) for the box foam producers. In the latter case (see below), this option is included because it has the lowest costs but a switch to variable pressure technology will be made wherever this is feasible during the implementation process.

The use of LCD technology is now an industry standard for flexible slabstock foam production. It is, however, expensive to apply for the small and medium-sized producers and this is reflected in the cost effectiveness of these conversions. Funding for conversion to LCD technology is proposed for 89 of the 109 enterprises with the remainder scheduled for closure, merger or conversion at their own costs.

For those enterprises for which it is proposed to finance LCD technology there is provision for LCD systems, storage tanks and building modifications. There is also provision for technology transfer, trials and training.

The use of MC is not encouraged for small producers because of health risks but, currently, it is the only technically proven technology which is cost effective for this sub-sector. Even so, it is not fully suitable for very low-density foams. An alternative is variable pressure (VPF) technology but this is significantly more expensive to apply for small producers. There is an undertaking in the project for the further consideration of VPF technology during implementation and advice on the health and safety aspects for the users of MC.

There is provision for equipment to store and meter MC as well as for ventilation and monitoring. Costs of technology transfer, trials and training are also provided for.

Integral Skin Foams

It is not clear from the project which are the end applications for the four integral skin manufacturers but, because the use of in-mould coating is proposed, it is presumed that these enterprises are supplying mouldings into the automotive industry.

The proposed CFC 11-replacement technology is CO_2 (water) blowing. This is the standard technology in use in most enterprises around the world. There is a need, in many cases, for moulding for the automotive industry to improve the skin quality and this is readily effected by the use of in-mould coatings. There is provision for this technology as well for modification

of the moulds for heating/temperature control, which is necessary with CO_2 (water) technology.

There is no provision for the retrofitting of the current dispensers. Current dispensers may be suitable but the replacement of seals and hoses is a common requirement. A description of the mould modifications, with respect to the baseline equipment, is necessary.

There is also provision for technology transfer, trials and training.

SAFETY AND ENVIRONMENTAL ISSUES

Regarding the transitional status of HCFC 141b – its phase-out date under the Montreal Protocol is 2040. Whilst enterprises should be aware of this and also be aware that subsequent transitions are at their expense, it is the only currently available replacement which is economic for small enterprises to use. A possible replacement for HCFC 141b is HFC 245fa but this does have a high GWP – in contradiction to the selection criteria under 4.13. The enterprises will, probably (not clarified) be supplied with pre-blended formulations and the training should cover their handling.

A significant safety issue is use of pentane for rigid foam. Whilst the appropriate equipment, safety audits and training are included there is also concern that the enterprises, given their small size, have sufficient in-house management resource for operating with pentane. Some "institutional strengthening" could be provided for.

The safe working with MC is a recognised concern, particularly as some enterprises not use dispensing machines. The need for local authority supervision is noted.

PROJECT COSTS

In the cost effectiveness calculations the residual ODP of HCFC 141b of 0.11 has to be taken into account and factored into the calculations. This will reduce the cost effectiveness of the sector using this blowing agent.

The capital costs and one off costs for the various sectors have been discussed under "Technology". There is technical justification for the expenditure. The training, technology transfer and trials costs are geared to the respective sizes of the enterprises.

Where applicable, ExCom decisions relating to density changes have been applied.

Regarding incremental operating costs, there is a need for more clarity in presentation. However, after deciphering the data it can be ascertained that most of these can be supported. But, there is a need for some additions and changes. For flexible foams the calculation for MC technology whereby there is zero incremental operating costs/savings should be explained. For LCD technology there is an across the board saving of $ 50,000 per unit. This should be

calculated for the individual enterprises based on displayed principles and summarised in the project document.

The chemical prices for the rigid foam and integral skin cases are supported. The differences in polyol and isocyanate costs between the two types of foams are shown.

Whilst the need for a set price (for the same product) is expected in a complex project, it would be useful to have a short discussion of the effect of purchasing volume on the prices. The purchasing power must vary considerably over the range of enterprises.

IMPLEMENTATION TIMEFRAME

Details are given of the year-by-year phase out programmes and these are supported.

RECOMMENDATION

Whilst there is room for improvement, especially with respect to incremental operating costs, the project is approved. The areas, which should be addressed, are noted in this review.

M Jeffs 11/05/2001

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