NATIONS
UNIES

EP

Programme des
Nations Unies pour
l'environnement

Distr.
GENERALE

UNEP/OzL.Pro/ExCom/56/23
11 octobre 2008

FRANÇAIS
ORIGINAL: ANGLAIS

COMITE EXECUTIF
DU FONDS MULTILATERAL AUX FINS
D'APPLICATION DU PROTOCOLE DE MONTREAL
Cinquante-sixième réunion
Doha, 8-12 novembre 2008

PROPOSITION DE PROJETS : BRÉSIL

Ce document comprend les observations et les recommandations du Secrétariat du Fonds sur la proposition de projets suivante :

Mousses

- Projet pilote pour la validation du formiate de méthyle comme agent de gonflage dans la fabrication de mousse de polyuréthanne (phase I) PNUD

Élimination

- Plan national d'élimination des CFC (septième tranche) PNUD

FICHE D'ÉVALUATION DE PROJET : PROJETS NON PLURIANNUELS
BRÉSIL

TITRE DU PROJET	**AGENCE D'EXÉCUTION/BILATÉRALE**
a) Projet pilote pour la validation du formiate de méthyle comme agent de gonflage dans la fabrication de mousse de polyuréthanne (phase I)	PNUD

AGENCE NATIONALE DE COORDINATION	Ministère de l'Environnement, MMA/PROZON

DERNIÈRES DONNÉES DÉCLARÉES SUR LA CONSOMMATION DE SAO À ÉLIMINER GRÂCE AU PROJET

A: DONNÉES RELATIVES À L'ARTICLE 7 (TONNES PAO, 2007, EN DATE DE SEPTEMBRE 2008)

HCFC	1 545,2		

B: DONNÉES SECTORIELLES DU PROGRAMME DE PAYS (TONNES PAO, 2007, EN DATE DE SEPT. 2008)

SAO				
HCFC				

Consommation restante de CFC admissible au financement (tonnes PAO)	0,0

AFFECTATIONS DANS LES PLANS D'ACTIVITÉS DE L'ANNÉE EN COURS		Financement (millions $US)	Élimination (tonnes PAO)
	a)	Selon la décision 55/43 e)	S.o.

TITRE DU PROJET :	
Consommation des SAO par l'entreprise: (tonnes PAO)	
SAO à éliminer (tonnes PAO) :	S.o.
SAO à introduire (tonnes PAO) :	S.o.
Durée du projet (mois) :	7
Montant initial demandé ($US) :	368 500
Coût final du projet :	368 500
Coûts différentiels d'investissement ($US)	335 000
Coûts pour les imprévus (10 %) ($US)	33 500
Coûts différentiels d'exploitation ($US)	
Coût total du projet ($US)	368 500
Participation locale au capital (%) :	100 %
Élément d'exportation (%) :	0 %
Subvention demandée ($US) :	368 500
Rapport coût-efficacité ($US/kg) :	S.o.
Coût d'appui à l'agence d'exécution ($US) :	27 638
Coût total du projet pour le Fonds multilatéral ($US) :	396 138
Financement de contrepartie confirmé (O/N) :	S.o.
Échéances de surveillance incluses (O/N):	O

RECOMMANDATION DU SECRÉTARIAT	Pour examen individuel

DESCRIPTION DU PROJET

1. Le PNUD présente à la 56e réunion du Comité exécutif, au nom du gouvernement du Brésil, un projet pilote pour la validation du formiate de méthyle comme agent de gonflage dans la fabrication de mousse de polyuréthanne (phase I) au Brésil. Le coût total de la phase I du projet pilote est de 368 500 $US, plus les coûts d'appui de 27 638 $US.

2. Le projet propose d'abord de développer, d'optimiser et de valider l'utilisation de formiate de méthyle dans la fabrication de mousse de polyuréthanne (phase I) et, si la technologie est validée, de l'appliquer dans un nombre restreint d'usines de fabrication de mousse en aval à des fins diversifiées, et de transférer la technologie aux entreprises de formulation intéressées (phase II).

3. Le formiate de méthyle est un produit chimique utilisé dans la fabrication d'autres produits chimiques et de certains articles, dont des produits pharmaceutiques et des insecticides. Bien qu'il soit déjà utilisé comme agent de gonflage dans la fabrication de caoutchouc synthétique, comme indiqué dans la documentation antérieure, Foam Supplies Inc., aux États-Unis, a été la première entreprise à l'utiliser dans la fabrication de mousse de polyuréthanne, en 2000. L'application a été brevetée sous l'appellation Ecomatemd, et une licence exclusive a été accordée aux entreprises suivantes : Purcom pour l'Amérique latine, BOC Specialty Gases pour le Royaume-Uni et l'Irlande, et Australian Urethane Systems pour l'Australie, la Nouvelle-Zélande et le littoral du Pacifique (l'entreprise de l'Australie a aussi acheté la licence pour d'autres pays au Moyen-Orient et en Afrique du Nord, de même que pour la Chine et l'Inde).

4. Le coût total de la phase I a été évalué à 368 500 $US, ventilé selon le tableau ci-dessous. Les coûts préliminaires de la phase II ont été évalués à 1 916 000 $US.

Description	**$ US**
Préparation du projet	30 000
Transfert de technologie et formation	25 000
Développement de la formule (7 utilisations à 5 000 $US chacune)	35 000
Optimisation (15 utilisations à 3 000 $US chacune)	45 000
Validation (15 utilisations à 2 000 $US chacune)	30 000
Équipement de laboratoire	115 000
Sécurité en laboratoire	10 000
Examen par des pairs/préparation de la phase suivante	20 000
Ateliers de dissémination de la technologie	25 000
Imprévus (10 pour cent)	33 500
Total	**368 500**

5. Comme il s'agit du premier projet pilote à faire la démonstration d'une technologie de remplacement des HCFC dans la fabrication de la mousse, un résumé du projet préparé par le PNUD est joint au présent document.

OBSERVATIONS ET RECOMMANDATIONS DU SECRÉTARIAT

OBSERVATIONS

6. Le Secrétariat a examiné le projet en tenant compte du document d'orientation sur l'analyse révisée des coûts pertinents du financement de l'élimination des HCFC présenté à la 55e réunion et la

décision 55/43 adoptée par le Comité exécutif, ainsi que le projet de validation complémentaire au Mexique, également présenté à la 56e réunion.

7. Le document sur les coûts relatifs aux HCFC examiné à la 55e réunion du Comité exécutif souligne l'importance d'obtenir la collaboration des entreprises de formulation choisies de pays visés à l'article 5 afin de valider les nouvelles technologies ou les technologies ayant subi d'importantes modifications aux fins d'utilisation dans les projets de HCFC dans des délais opportuns et ainsi permettre aux projets d'investissement de profiter immédiatement de la validation. Le Secrétariat a pris note que la proposition présentée par le PNUD a abordé la question comme suit :

a) Purcom (le détenteur de licence de la technologie à base de formiate de méthyle pour le Brésil) a accepté d'accorder des sous-licences non exclusives à toutes les entreprises de formulation de la région admissibles au financement en vertu des règles du Fonds multilatéral ;

b) Les ateliers de diffusion de la technologie seront offerts aux entreprises de formulation dès que la technologie sera jugée prête au transfert ;

c) Purcom communiquera avec les détenteurs de licence dans les autres régions afin de leur proposer une démarche semblable.

8. Le Secrétariat a soulevé plusieurs points au sujet du projet, auxquels le PNUD a répondu comme suit :

a) Rien n'indique si les trois entreprises du Brésil, du Royaume-Uni et de l'Irlande qui détiennent une licence exclusive pour la technologie à base de formiate de méthyle accepteraient de partager entre elles les résultats de la validation de la technologie dans les différentes utilisations liées à la mousse. Ce partage aurait des avantages, surtout pour les entreprises de formulation du Brésil (qui englobent la région de l'Amérique latine et des Caraïbes) et de l'Australie (qui englobent les régions du littoral du Pacifique, du Moyen-Orient et de l'Afrique du Nord). Le Secrétariat a aussi suggéré que le PNUD invite les autres détenteurs de licence de la technologie à participer au projet et à faciliter le transfert aux détenteurs de licence de la technologie pour les différentes utilisations validées ;

Le PNUD a répondu que la proposition du Secrétariat est intéressante, mais qu'elle ne peut pas être réalisée dans le court délai entre la 55e réunion, à laquelle la décision 55/43 a été adoptée, et la proposition du projet pilote à la 56e réunion. Toutefois, le PNUD a convoqué une réunion avec le détenteur du brevet de la technologie Ecomate lors du congrès technique sur le polyuréthanne de 2008, à San Antonio, au Texas, au début octobre 2008, afin de commencer à discuter de l'esprit de la proposition du Secrétariat. La réunion a suscité énormément d'intérêt de la part de Australian Urethane Systems en vue de l'application d'une approche semblable dans le littoral du Pacifique. De plus, l'entreprise australienne assistera à l'atelier de diffusion d'information qui marquera la fin du projet pilote et prendra ensuite une décision finale sur sa collaboration possible (la collaboration entre ces entreprises semble pratiquement assurée).

b) La production actuelle et future de formiate de méthyle pourra-t-elle répondre à la demande, en supposant que la technologie est validée et présente un bon rapport coût-efficacité pour la plupart ou la totalité des activités de fabrication de mousse faisant l'objet de la proposition ?

Le PNUD a indiqué que le formiate de méthyle est un produit chimique utilitaire très abondant sur le marché et vendu comme matière première et pour la fabrication de solvants. Son utilisation en tant qu'agent de gonflage n'influera pas sur son accessibilité. Les normes de pureté pourraient toutefois exiger qu'il subisse une étape de distillation supplémentaire.

c) Selon le projet, Purcom a déjà validé et optimisé la technologie à base de formiate de méthyle dans la mousse à pellicule externe incorporée (volants de voiture), les panneaux (non continus) et la réfrigération commerciale (refroidisseurs de bouteilles) et utilisé la technologie à des fins commerciales. Le Secrétariat a demandé si la validation de la technologie dans ces utilisations a été confirmée par des experts en mousse indépendants, et à connaître les avantages de la validation de la technologie dans ces utilisations pour le Fonds multilatéral (c.-à-d., les pays visés à l'article 5) ;

Le PNUD a indiqué que l'utilisation de formiate de méthyle dans certains processus de fabrication de mousse à pellicule externe incorporée n'a été validée que par des clients et des utilisateurs par des moyens internes, ce qui ne constitue pas une validation officielle. La seule exception pourrait être la fabrication de volants de voiture, qui a réussi les tests d'abrasion de Volkswagen. Comme cette utilisation n'a été développée que par Purcom, elle ne relève pas du domaine public négocié par le PNUD pour les utilisations acceptées par le Fonds multilatéral. La validation de cette technologie dans la fabrication de mousse à pellicule externe incorporée exigerait la somme supplémentaire de 33 000 $US afin d'acheter de l'équipement supplémentaire (pour le test d'abrasion) et effectuer des tests.

9. Il est proposé que le Secrétariat du Fonds valide les résultats obtenus de l'application de la technologie en faisant appel à un expert compétent indépendant et que cette validation soit réalisée sous la supervision du comité des choix techniques pour la mousse du PNUE. Le Secrétariat a pris note des préoccupations du PNUD au sujet de la validation de la technologie par des experts indépendants. Il a toutefois précisé qu'il ne possède pas l'expertise, le budget ni le mandat de valider la technologie, quelle qu'elle soit. Le Secrétariat a donc suggéré que le PNUD maintienne des communications ouvertes avec le Comité des choix techniques pour la mousse au cours du processus de validation, aux fins d'examen. Le PNUD a indiqué que le Comité des choix techniques pour la mousse, le PNUD et Purcom se sont réunis en octobre 2008 et qu'au cours de la réunion, Purcom a informé le Comité des choix techniques pour la mousse des progrès accomplis et le PNUD a expliqué la proposition de projet pilote présentée à la 56^{e} réunion du Comité exécutif. Le PNUD a aussi indiqué qu'en principe, le Comité des choix techniques pour la mousse accepte de mener une évaluation par les pairs et qu'il communiquera avec le PNUD et/ou le Secrétariat afin de discuter des détails.

10. Le Secrétariat et le PNUD ont discuté de plusieurs points entourant la consommation de HCFC au Brésil et de sa répartition sectorielle visant à respecter les engagements des entreprises de formulation d'émettre des sous-licences aux entreprises de formulation régionales, et des modalités de diffusion des résultats du projet à d'autres entreprises de formulation. Le PNUD a indiqué qu'il a conclu un accord avec Purcom pour offrir des sous-licences non exclusives à d'autres entreprises de formulation de l'Amérique latine et des Caraïbes. Le PNUD estime toutefois que les détails de ces ententes doivent demeurer entre le détenteur de licence et le détenteur de la sous-licence. Le PNUD a aussi indiqué que les entreprises de formulation en Argentine (3), au Chili (2), en Colombie (5) et au Mexique (8) seront toutes invitées à participer à l'atelier. Le PNUD a aussi également des demandes d'entreprises de formulation de l'Inde, qui désirent participer à l'atelier. Il faudra peut-être prévoir plus d'un atelier si le PNUD réussit à convaincre les autres détenteurs de licence (surtout l'Australie) de respecter des politiques de transfert semblables dans leur région.

11. Le Secrétariat et le PNUD ont discuté des coûts, dont les 25 000 $US demandés pour le transfert de technologie et la formation, car Purcom détient la licence complète pour l'utilisation de la technologie à base de formiate de méthyle. Quant à l'équipement de laboratoire demandé (dont deux distributeurs de mousse pour la somme totale de 70 000 $US), il a été noté que l'entreprise s'adonne déjà à ce genre d'activités et comme elle est la plus importante entreprise de formulation du Brésil et qu'elle fournit différentes formules pour la fabrication de la mousse, cet équipement fait partie de son équipement de référence. Le PNUD a indiqué que Purcom doit recevoir une formation sur l'utilisation de l'équipement de validation. Le programme de validation mis au point par l'expert international du PNUD doit être communiqué et la validation doit être dirigée par l'expert du PNUD afin qu'elle soit validée par le Comité des choix techniques pour la mousse. Le PNUD a aussi indiqué que l'équipement demandé pour la validation ne fait pas partie de l'équipement de référence de l'entreprise.

RECOMMANDATION

12. Comme le Comité exécutif, dans sa décision 55/43 e), a invité les agences d'exécution et bilatérales à préparer et à présenter en toute urgence, un nombre précis de projets faisant appel à des entreprises de formulation et/ou des fournisseurs de produits chimiques pour le développement, l'optimisation et la validation des formules chimiques à utiliser avec des agents de gonflage à base de HCFC et à la lumière des observations du Secrétariat, le Comité exécutif pourrait souhaiter :

a) Approuver le projet pilote pour la validation du formiate de méthyle comme agent de gonflage de la mousse dans la fabrication de mousse de polyuréthanne au Brésil (phase I) pour la somme de 368 500 $US, plus les coûts d'appui de 27 638 $US pour le PNUD ;

b) Approuver la somme supplémentaire de 33 000 $US, plus les coûts d'appui de 2 475 $US, pour la validation du formiate de méthyle comme agent de gonflage dans la fabrication de produits en mousse à pellicule externe incorporée.

FICHE D'EVALUATION DE PROJET – PROJETS PLURIANNUELS

Brésil

(I) TITRE DU PROJET	ORGANISME:
Plan d'élimination de CFC	Allemagne, PNUD

(II) DERNIERES DONNEES DE L'ARTICLE 7 (Tonnes PAO)			ANNEE: 2007	
CFC: 318.1	CTC: 50.3	Halons: 1.6	MB: 100.4	TCA: 0

(III) DERNIERES DONNEES SECTORIELLES DU PROGRAMME DE PAYS (Tonnes PAO)								ANNEE: 2007					
Substances	Aérosols	Mousses	Halons	Refrigération		Solvants	Agents de transformation	Inhalateurs a doseur	Utilisation de laboratoire	Bromure de méthyle		Gonflage de tabac	Total Sector Consumption
				Fabrication	Services d'entretien					QPS	Non QPS		
CFC								279.3					279.3
CTC							50.3						50.3
Halons			1.6										1.6
Methyl Bromide										100.4			100.4
TCA													0

(IV) DONNEES DU PROJET			2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Limites de la consommation du Protocole de Montréal		CFC	10,525.8	10,525.8	10,525.8	10,525.8	10,525.8	5,262.9	5,262.9	1,578.9	1,578.9	1,578.9	0.	
Consommation maximale permise (Tonnes PAO)		CFC	9,276.	9,276.	8,280.	6,967.	5,020.	3,070.	2,050.	1,000.	424.	74.	0.	
Couts de projet ($US)	Allemagne	Coûts de projet			577,137.	1,062,863.	1,000,000.	1,000,000.	243,600.					3,883,600.
		Coûts de soutien			51,942.	95,658.	90,000.	90,000.	21,924.					349,524.
	PNUD	Coûts de projet			7,860,000.		5,420,000.	4,270,000.	2,856,400.	1,190,000.	870,000.	250,000.	100,000.	22,816,400.
		Coûts de soutien			687,700.		473,000.	369,500.	242,276.	92,300.	63,500.	12,500.	5,000.	1,945,776.
Total des fonds approuvés en principe ($US)		Coûts de projet			8,437,137.	1,062,863.	6,420,000.	5,270,000.	3,100,000.	1,190,000.	870,000.	250,000.	100,000.	26,700,000.
		Coûts de soutien			739,642.	95,658.	563,000.	459,500.	264,200.	92,300.	63,500.	12,500.	5,000.	2,295,300.
Total des fonds débloqués par le Comité exécutif ($US)		Coûts de projet			8,437,137.	6,420,000.	1,062,863.	6,826,400.	2,733,600.	870,000.	0.	0.	0.	26,350,000.
		Coûts de soutien			762,727.8	563,000.	95,658.	584,776.	231,224.	63,500.	0.	0.	0.	2,300,885.8
Total des fonds demandés pour l'année en cours ($US)		Coûts de projet										250,000.		250,000.
		Coûts de soutien										12,500.		12,500.

(V) RECOMMANDATION DU SECRETARIAT:	Approbation générale

QPS: Applications sanitaires préalables à l'expédition

Non-QPS: Applications autres que sanitaires et préalables à l'expédition

DESCRIPTION DU PROJET

13. Le PNUD présente à la 56e réunion du Comité exécutif, au nom du gouvernement du Brésil, une demande pour le financement de la septième phase du plan national d'élimination des CFC d'une somme de 250 000 $US, plus les coûts d'appui de 12 500 $US, aux fins d'examen. La demande est accompagnée d'un rapport sur la mise en œuvre du plan à ce jour et d'un rapport de vérification pour l'année 2007. Le plan a pour objet d'éliminer complètement la consommation de CFC au Brésil d'ici 2010 depuis la valeur de référence de 8 280 tonnes PAO en 2002.

Contexte

14. Le plan est mis en œuvre avec l'assistance du PNUD, en qualité d'agence d'exécution principale, et du gouvernement de l'Allemagne, en qualité d'agence de coopération pour le volet de formation des techniciens en réfrigération et des agents de douane. Le gouvernement de l'Allemagne a reçu sa dernière allocation lors du décaissement de la cinquième tranche. Le plan national d'élimination des CFC pour le Brésil a été approuvé par la 37e réunion du Comité exécutif, en juillet 2002, pour la somme de 26,7 millions $US. La somme approuvée à ce jour pour les six premières tranches s'élève à 26 350 000 $US, plus les coûts d'appui de 2 300 885,80 $US.

Vérification de la consommation

15. Le rapport de vérification présenté confirme les données communiquées par le Brésil concernant sa consommation de 318,1 tonnes PAO de CFC en 2007, ce qui correspond aussi aux données communiquées en vertu de l'article 7. Le rapport de vérification fait également état des activités mises en œuvre dans le cadre du plan national d'élimination.

16. Lors de l'approbation de la tranche précédente, le Comité exécutif a demandé au PNUD de faire rapport sur les progrès dans l'application du programme de contingent à tous les SAO, lors de la présentation de la demande pour la septième tranche. Cette demande était fondée sur la perception du vérificateur à l'époque, à l'effet que le programme de contingent ne s'appliquait qu'au CFC-12. La réglementation publiée en septembre 2000 et entrée en vigueur en janvier 2001 interdit l'utilisation de toutes les substances des annexes A et B, à quelques exceptions près, notamment le tableau des limites d'importation prédéfinies de CFC-12. Les autres exceptions concernent les utilisations dans les extincteurs d'incendie, comme agents de transformation, à des fins médicales et autres, et les importations pour toutes ces utilisations exigent un permis d'importation particulier. Cette réglementation constitue, à toutes fins pratiques, un programme de contingent pour les SAO des annexes A et B. Il n'y a aucun rapport de programme pour les substances des annexes C et E. Le rapport propose plusieurs recommandations supplémentaires pour IBAMA, l'agence nationale chargée d'appliquer la politique environnementale, afin de renforcer les contrôles à l'exportation et les inspections.

Réalisations en 2007

Surveillance de projet, sensibilisation et activités gouvernementales

17. Le Groupe de mise en œuvre et de suivi a poursuivi la surveillance et la mise en œuvre des sous-projets du plan en octroyant des contrats de sous-traitance, en organisant les achats et en supervisant l'exécution financière et budgétaire. Les activités de sensibilisation du public visant à diffuser de l'information sur le plan national d'élimination des CFC se sont poursuivies, notamment des projets spéciaux pour célébrer le 20e anniversaire du Protocole de Montréal. Une nouvelle réglementation a été publiée. Il s'agit de l'ordre administratif GM/MS n. 2799, qui établit un « critère d'absence de CFC pour les achats d'inhalateurs à doseur effectués par le ministère de la Santé à compter du 1er janvier 2008. »

Exécution

18. Une nouvelle activité intitulée « Contrôle du trafic illicite » a vu le jour en 2008 et en est aux étapes préparatoires de la mise en œuvre.

Secteur de l'entretien de l'équipement de réfrigération

19. Au total, 4 208 techniciens ont été formés en pratiques exemplaires en réfrigération en 2007. Le programme de récupération du CFC-12 a donné lieu à la distribution de 296 appareils de récupération, 25 trousses d'équipement de récupération et de recyclage de climatiseurs d'automobile et 60 trousses d'outils avec sacs de récupération. Deux centres de régénération ont été établis au cours de cette même période. Des accords sur l'élimination finale des réfrigérateurs à base de CFC remplacés ont été signés avec six entreprises de services publics et électriques dans le cadre du sous-projet de récupération du CFC-12 et d'efficacité énergétique.

20. D'importants progrès supplémentaires ont été accomplis en 2008, dont la formation de 3 808 techniciens de plus et la distribution de 1 144 appareils de récupération supplémentaires à ce jour.

Secteur de la fabrication de la mousse

21. Le dernier élément de ce sous-projet a été achevé par la reconversion de 20 entreprises du secteur de la mousse de polyuréthanne souple.

Secteurs des solvants et des inhalateurs à doseur

22. Trois sondages ont été réalisés afin de recenser les producteurs, les importateurs et les exportateurs potentiels d'inhalateurs à doseur, de recenser les inhalateurs à doseur à base de CFC et d'identifier et de compiler une liste des inhalateurs à doseur sans CFC au pays. Un symposium de sensibilisation aux effets de l'appauvrissement de la couche d'ozone sur la santé a été organisé à l'intention des associations et des professionnels de la santé, ainsi qu'une consultation publique sur l'interdiction prochaine de fabriquer et d'importer des inhalateurs à doseur à base de CFC.

23. Aucune activité n'a été nécessaire dans le secteur des solvants, comme indiqué lors de la demande de la tranche précédente. Les fonds destinés à ces activités ont donc été utilisés pour le financement d'autres activités.

24. Les données communiquées sur les accords pluriannuels révèlent qu'à ce jour, y compris l'année 2008, les dépenses s'élèvent à 24 358 959 $US ou 91,1 pour cent de la somme totale approuvée. La récapitulation de l'état des dépenses est fournie dans le tableau ci-dessous. Il précise les dépenses dans tous les principaux groupes d'activités pour l'année 2007, les dépenses à ce jour en 2008 et la façon dont celles-ci se comparent aux prévisions pour l'ensemble du plan. Enfin, le tableau fournit également les chiffres de l'année prochaine. Il semble évident que le projet s'est bien déroulé et que l'achèvement approche, sans qu'il ait été nécessaire d'apporter de changements importants aux dépenses.

	Dépenses ($US)				
	2007	**2008**	**Total à ce jour**	**% du budget global dépensé**	**Prévisions pour 2009**
Mesures législatives	26 773	117 807	274 985	38,66 %	436 315
Pratiques exemplaires	535 268	700 406	3 211 426	83,15 %	650 973
Investissements dans l'entretien en réfrigération	6 853 164	2 070 590	13 939 230	95,54 %	651 000
Fabrication d'équipement de réfrigération	0	0	52 079	100,00 %	0
Mousses	320 000	599 351	4 552 065	105,32 %	61 090
Solvants	2 977	0	6 838	100,00 %	0
Inhalateurs à doseur	10 987	106 748	122 870	61,44 %	77 130
Groupe de la gestion des projets	556 100	488 596	2 199 466	73,44 %	405 534
Total	8 305 269	4 083 498	24 358 959	91,10 %	2 282 042

Plan de mise en œuvre pour l'année 2009

25. Plusieurs activités sont prévues en ce qui a trait à la surveillance des projets, la sensibilisation et les activités gouvernementales. Le Groupe de mise en œuvre et de suivi continuera à assurer un soutien technique et d'exploitation à la gestion des activités du plan. Les campagnes de sensibilisation se poursuivront afin d'informer les acteurs du plan national d'élimination des CFC, surtout les volets de récupération et de recyclage. Des politiques sont prévues pour améliorer la réglementation des importations et des exportations de substances mixtes contenant des CFC et renforcer le registre technique d'IBAMA, et aussi pour intégrer les plans d'élimination des CFC et des futurs HCFC au plan national du gouvernement sur les changements climatiques. Les agents des douanes continueront à recevoir de la formation dans le cadre de nouvelles activités pour lutter contre le commerce illicite, et le programme de permis d'importation/exportation sera amélioré, en application du sous-projet.

26. Les activités suivantes sont prévues dans le sous-secteur de l'entretien de l'équipement de réfrigération : surveillance de l'utilisation des appareils de récupération déjà distribués ; distribution de 3 000 trousses d'outils et de sacs de récupération supplémentaires, ainsi que de 5 appareils de récupération pour le secteur des refroidisseurs, et 114 centres de recyclage seront identifiés et équipés. Les trois centres de régénération des CFC-12 restants seront inaugurés officiellement tandis que la surveillance se poursuivra dans les deux centres existants, et des ateliers locaux et régionaux seront organisés afin de faire connaître les activités des centres. Six mille techniciens en réfrigération de plus recevront une formation en pratiques exemplaires en réfrigération.

27. Les campagnes de dissémination sur la transition aux inhalateurs à doseur sans CFC se poursuivront dans le secteur des inhalateurs à doseur, et la réglementation sera appliquée. Plusieurs activités sont prévues, dont la tenue d'un atelier sur la transition à l'intention des États et des municipalités, la publication d'articles sur le sujet dans les journaux médicaux spécialisés, la rédaction de matériel de formation et à disséminer, et la publication d'une résolution interdisant la fabrication et l'importation d'inhalateurs à doseur à base de CFC à partir du 1er janvier 2011.

OBSERVATIONS ET RECOMMANDATIONS DU SECRÉTARIAT

OBSERVATIONS

28. Le Secrétariat a demandé des précisions sur les mesures législatives exigeant l'élimination de la fabrication d'inhalateurs à doseur d'ici janvier 2011, y compris l'utilisation potentielle d'inhalateurs à doseur à base de CFC au cours de 2010. Le PNUD a répondu que la consommation de CFC-12 en 2008 et 2009 a été réservée exclusivement aux inhalateurs à doseur et qu'il est interdit d'importer le CFC-12 aux fins d'utilisation dans le secteur de l'entretien de l'équipement de réfrigération. Les fabricants d'inhalateurs à doseur pourront continuer de fabriquer des inhalateurs à doseur à base de CFC en 2010 en puisant dans leurs stocks, mais les nouvelles importations seront interdites.

29. La mise en œuvre du nouveau plan national d'élimination des CFC pour le Brésil s'est bien déroulée. Dans l'accord, le pays a accepté des réductions considérables de CFC inférieures aux limites de consommation du Protocole de Montréal (1 578,9 tonnes PAO), notamment 1 000 tonnes PAO pour l'année 2007, 424 tonnes PAO pour l'année 2008 et 74 tonnes PAO pour l'année 2009. La consommation vérifiée de 2007 a été de 318,1 tonnes PAO, ce qui est de loin inférieur à la consommation maximum permise pour l'année 2008.

30. La mise en œuvre du plan national d'élimination des CFC pour le Brésil est très avancée. Elle a été réalisée en utilisant une approche générale comprenant non seulement des activités bien établies telles que la formation des techniciens et des agents de douane, et les investissements qui s'y rapportent, mais aussi des activités inhabituelles telles que la récupération à la fin de vie des réfrigérateurs. Le plan national d'élimination des CFC est inhabituel car il combine le financement et les activités aux travaux d'efficacité énergétique, notamment l'élimination des réfrigérateurs et leur remplacement par de nouveaux appareils éconergétiques. Le pays, avec le soutien actif des agences d'exécution, pourrait donc créer de nombreux bienfaits et assurer la durabilité de l'élimination et des investissements.

31. Le plan national d'élimination des CFC pour le Brésil est un modèle dans la remise des rapports depuis plusieurs années, ce qui a permis d'assurer un suivi précoce des progrès en vue de la réalisation des objectifs. Entre temps, ce type de suivi a été intégré à la plupart des plans d'élimination grâce aux tableaux d'accords pluriannuels. Plus de 50 pour cent du financement a été dépensé au cours de l'année visée par le rapport et les premiers mois de 2008, ce qui représente une augmentation marquée dans les activités de mise en œuvre par rapport aux quatre premières années, une situation qui avait causé certaines inquiétudes au Secrétariat.

RECOMMANDATION

32. Le Secrétariat du Fonds recommande l'approbation générale de la septième tranche du plan national d'élimination des CFC pour le Brésil et des coûts d'appui connexes au niveau de financement indiqué dans le tableau ci-dessous.

	Titre du projet	Financement du projet ($US)	Coûts d'appui ($US)	Agence d'exécution
a)	Plan national d'élimination des CFC (septième tranche)	250 000	12 500	PNUD

COUNTRY:	**Brazil**	**IMPLEMENTING AGENCY: UNDP**
PROJECT TITLE:	**Pilot project for validation of Methyl Formate as a blowing agent in the manufacture of polyurethane foam (Phase-I)**	
PROJECT IN CURRENT BUSINESS PLAN:		**Based on ExCom Decision 55/43(e i-iii)**
SECTOR:		**Foams**
Sub-Sector:		**All sub-sectors (except shoe soles)**
ODS USE IN SECTOR		
Baseline:		**Not yet determined**
Current (2007):		**6,403 t (HCFC 141b imported** as per Government reporting**)**
BASELINE ODS USE:		**N/A**
PROJECT IMPACT (ODP targeted):		**N/A**
PROJECT DURATION:		**7 months**
PROJECT COSTS:		**US$ 368,500 (Phase-I only)**
LOCAL OWNERSHIP:		**100 %**
EXPORT COMPONENT:		**0 %**
REQUESTED MLF GRANT:		**US$ 368,500**
IMPLEMENTING AGENCY SUPPORT COST:		**US$ 27,638 (7.5 %)**
TOTAL COST OF PROJECT TO MLF:		**US$ 396,138**
COST-EFFECTIVENESS:		**N/A**
PROJECT MONITORING MILESTONES:		**Included**
NTL. COORDINATING AGENCY:		**Ministry of Environment - MMA/PROZON**

PROJECT SUMMARY

Brazil became a Party to the Vienna Convention and Montreal Protocol on 19 March, 1990. Brazil also ratified the London, Copenhagen, Montreal and Beijing Amendments. The country is fully committed to the phaseout of HCFCs and willing to take the lead in assessing new HCFC phaseout technologies

The objective of this project is to develop, optimize, validate and disseminate the use of methyl formate in PU foam applications. The project is divided in two distinct phases:

Phase-I: development, optimization and validation and technology dissemination
Phase-II: implementation in 15 downstream enterprises covering all relevant applications

At this stage funding only for Phase-I is requested. The costs Phase-II are included as a preliminary indicative estimate. The Phase-II costs will be updated after completion of Phase-I and submitted for approval in 2009.

IMPACT OF PROJECT ON COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

This project is a pilot project aimed to validate a new HCFC phase-out technology and will contribute indirectly to Brazil's Montreal Protocol obligations. If successfully validated, the technology will contribute to availability of cost-effective options that are urgently needed to implement HCFC phase-out, particularly at SMEs.

Prepared by: Bert Veenendaal **Date: October 2008**

PROJECT OF THE GOVERNMENT OF BRAZIL

PILOT PROJECT FOR VALIDATION OF METHYL FORMATE AS A BLOWING AGENT IN THE MANUFACTURE OF POLYURETHANE FOAM

1. PROJECT OBJECTIVES

The objectives of this project are to:

1. Develop, optimize and validate the use of methyl formate in polyurethane foam applications;
2. Apply the technology in a limited amount of downstream operations;
3. Transfer the technology to interested system houses

2. INTRODUCTION

Current validated technologies for replacing HCFC-141b in foams are restricted to water/MDI, hydrocarbons and HFCs. With water non-performing in most applications, HFCs being high in GWP and hydrocarbons high in investment costs, it is important to validate other options. ExCom Decision 55/43 reflect this by promoting pilot projects aimed to validate technologies. UNDP completed two related pilot proposals, for the validation of methyl formate (ecomate®) in all relevant foam applications. Technology validation is a global task. However, it has to be executed in a particular country and UNDP has therefore requested endorsement letters from the countries involved. However, because of the global impact complete deduction from the national aggregate HCFC consumption would not be fair.

3. INFORMATION ON PARTICIPATING COMPANIES

This pilot project is designed around Purcom Quimica LTDA ("Purcom"). Contact information is as follows:

Company: Purcom Quimica LTDA
- Contact: Mr. Gerson Silva, Technical Director
- Address: Rua Aeroporto 83/115, 06419 260 Barueri, SP, Brazil
- Ph/Fx: +5511-416-18902/+5511-416-84683
- Email: gerzon@purcom.com.br

Purcom was founded May 2002 and is 100 Brazilian owned. The company is the largest independent system house in Brazil and specializes in tailor-made PU systems covering virtually all applications except shoesoles. Annual sales have developed as follows (rounded):

2005 US$ 10,000,000 2006 US$ 14,000,000 2007: US$ 26,000,000

Export amounts to less than 3% (Argentina, Chile, Colombia and Mexico). The company employs about 50. Base chemicals are purchased from Air products, Bayer, Dow, Evonic, and Huntsman. The company processes following auxiliary blowing agents (2007):

• HCFC-141b	70 %	940 t	all rigid and integral skin applications
• Methyl Formate	15 %	200 t	steering wheels, bottle coolers
• Methylene Chloride	10 %	130 t	packaging foams
• HFCs	5 %	65 t	specialty applications

Methyl formate systems are sold under the name "ecomate®" and based on a license from FSI, USA. Purcom has developed these systems further and applied so far for 4 patents on new applications.

Purcom has identified companies covering 15 applications that address virtually all HCFC-consuming PU applications in Brazil. **Annex-3** lists the applications involved, and preliminary estimates of chemical consumption of PU systems as well as the HCFC-141b they contain. Verification of data and more information will be collected during the preparation of phase II.

4. PROJECT DESCRIPTION

The project is divided into two phases:

- Phase-I: development, optimization, validation, technology dissemination
- Phase-II: implementation at recipients covering all applications

4.1 PHASE-I

PU foams are used in applications that have different formulation requirements. Around 16 applications use currently HCFC-141b and 15 of these are produced by Purcom (shoesoles, will be a separate pilot project in Mexico). Development, optimization and validation of methyl formate as replacement technology for HCFC-141b will involve the systems house only. Purcom has already developed the technology for 8 applications (ref. **Annex-3**). It commercialized their use in three applications—steering wheels, discontinuous panels and bottle coolers. However, testing programs were hampered by insufficient testing equipment. Phase-I therefore will consist of:

- Acquisition of the necessary testing/prototyping equipment;
- Development of the remaining 7 applications;
- Optimization and Validation of all formulations except steering wheels on prototyping equipment that can simulate process conditions;
- Dissemination of the experience gained through a workshop.

Changing the blowing agent, which is an essential element in the formulation, requires the determination of baseline values for critical properties. While some, such as density, are general in nature, others are specific such as the following list shows:

Foam type	Application	Status	Critical Properties	Action
Integral Skin	Steering wheels	Partially proven	Friability, surface Skin adhesion	No action
	Shoe soles	Not developed	Surface	Validation
	Structural (rigid)	Developed	Surface	Validation
	Semi-flexible	Developed	Surface	Validation
Rigid Insulation	Domestic refrigeration	Not developed	Insulation, adhesion	Validation
	Commercial refrigeration	Developed	Insulation, adhesion	Validation
	Water heaters	Developed	Insulation, adhesion	Validation
	Trucks	Not developed	Insulation, adhesion	Validation
	Panels-continuous	Not developed	Insulation, adhesion	Validation
	Panels-discontinuous	Developed	Insulation, adhesion	Validation
	Spray	Not developed	Insulation, adhesion	Validation
	Blocks	Not developed	Insulation	Validation
	Thermoware	Not developed	Insulation, adhesion	Validation
	Pipe-in-pipe	Not developed	Insulation, adhesion	Validation
Flexible Foams	Hyper-soft molded	Developed	Appearance, touch	Validation
	Hyper-soft slabstock	Developed	Appearance, touch	Validation
	Low resilience	Developed	Resilience curve	Validation

Companies and their suppliers do not conduct regular testing on the properties of their foams nor do they set standards. Therefore the acquisition of suitable testing equipment and the determination of baseline data on critical properties is a precondition for a successful validation program. In addition, prototyping equipment is required to limit burdensome and costly downstream production testing to a minimum. The outcome of this part of the project will be a list of application-specific product requirements and tests to measure these. After this, optimization and validation can start in earnest.

Based on the outcome of this program, the technology will then be technically cleared for industrial application under Phase-II as well for dissemination to interested system houses. Past experience has shown how important it is to assure commercial availability and local technical support. In this project, following action is proposed to achieve this goal to the extent possible:

- UNDP has requested—and Purcom, as exclusive licensee for "ecomate®" technology in the regional area, has agreed to—offering non-exclusive sub-licenses to all regional system houses in good standing (= meeting MLF participation financial and eligibility criteria);
- Technology dissemination workshops will be conducted for interested systems houses as soon as the technology is deemed transferable;
- UNDP has contacted licensees in other A5 regions and proposed the same approach. The response was a tentative "yes". These companies will attend the dissemination workshops and then decide on a definite commitment.

While this may be not the immediate most profitable course for a system house with an exclusive license, it is the price to be paid for MLF support. It should be emphasized that, while other system houses can be briefed at no cost in MEF technology, they remain independent in their choice of phaseout technologies.

7.2 PHASE-II

After the formulation for a particular application has successfully passed its evaluation, UNDP will apply for approval of the second project phase, which is application in a manufacturing context.
15 companies, covering all applications, will apply the technology in their operations. Product and process testing will be conducted at downstream level by the system house. UNDP will contribute to this evaluation by conducting safety audits that includes workers exposure testing. Process adaptations will be made as needed to meet requirements as indicated in the previous table.

7.4 Supervision Arrangements

1. Decision 55/43 requires Agencies to report accurate project cost data as well as other data relevant to the application of the technologies through *"a progress report after each of the two implementation phases"*. UNDP suggests in addition the ExCom to consider supervision of the validation through the UNEP Foams Technical Options Committee

8. TECHNICAL OPTIONS FOR HCFC REPLACEMENT IN PU FOAMS

8.1 GENERAL OVERVIEW

Annex-2 provides an overview of all HCFC-141b replacement technologies that are currently available or proposed. Based on these data, it appears that

- Straight conversion of HCFCs to HFCs will always increase GWP
- HCs, CO_2 (LCD or derived from water)and methyl formate will be options in PU foams that decrease—virtually eliminate—GWP in PU foams
- Emerging technologies such as HBA-2, AFA-L1 and FEA 1100 will require at least two more years before commercialization

It follows that PU validation may include following technologies:
- Carbon Dioxide
- Hydrocarbons
- Methyl Formate

8.2 METHYL FORMATE AS REPLACEMENT TECHNOLOGY FOR HCFC-141b

Annex-2 provides an extensive overview of the properties and use of methyl-formate, also called methyl-methanoate, or (trade name) ecomate©. Foam Supplies, Inc. (FSI) has pioneered its use in PU foams from 2000 onwards. The application has been patented in several countries. Ecomate®, as FSI calls the product, is exclusively licensed to Purcom for Latin America, to BOC Specialty Gases for the United Kingdom and Ireland and to Australian Urethane Systems (AUS) for Australia, New Zealand and the Pacific Rim. Reportedly, AUS has also acquired the license for other countries such as India, China and several MENA countries.

Technical and commercial claims made by FSI imply that the technology actually may reduce operating costs when replacing HCFC-141b, at minimum capital investment and comparable or better quality. This, of course would be of utmost interest for the MLF. However, these claims need to be verified and validated by an independent body before the technology can be applied in MLF projects. Where insufficient data have been provided, additional data will have to be developed.
Reportedly, Brazil is the only A5 country where ecomate® is blended. The licensee for Latin America, Purcom, stated that it has spent much effort in system development for ecomate® which has by now replaced about 15% of their HCFC consumption. Current commercial applications (which indicate mature product) are in integral skin foam (steering wheels), panels (discontinuous) and commercial refrigeration (bottle coolers). Because the technology is more costly than HCFC-141b (Purcom indicates ~10%), customers use it only when the market demands it. This is the case for international corporations and for construction on behalf of international corporations

9. PROJECT COSTS

Cost forecasts for pilot projects are very difficult to prepare as such projects, by nature, are unpredictable. UNDP has as much as possible used the guidance provided by the Secretariat in Document 55/47 Annex III, Appendix II. Deviations from this document are explained.

One uncertainty is the flammability of methyl formate. The MSDS mention the substance to be “extremely flammable” respectively “explosive in vapor/air mixes”. On the other side, a study shows that emissions from the actual foam process are <100 ppm and therefore below applicable explosion limits.

UNDP considers the process at the system house (prototyping, blending) hazardous and requiring adequate safeguards but the use of pre-blended systems non-flammable. That implies that from the 15 applications only 3 (all continuous operations that direct meter the blowing agent) are deemed to require safeguards. Consequently, the Secretariat’s template for flammable blowing agents is used in four cases and the one for non-flammable substances 12 cases. This has a beneficial impact on the budget and leads to the following summarized cost expectations:

#	ACTIVITY	COSTS (US$)		
		INDIVIDUAL	SUB-TOTAL	TOTAL

	PHASE-I – DEVELOPMENT/OPTIMIZATION/VALIDATION/DISSEMINATION			
1	Preparative work Project Preparation Technology Transfer, Training	 30,000 25,000	 55,000	
2	System Development (7 applications) @ 5,000 Optimization (15 applications) @ 3,000 Validation (15 applications) @ 2,000	35,000 45,000 30,000	 110,000	**368,500**
3	Laboratory Equipment Laboratory Safety	115,000 10,000	 125,000	
4	Peer review/preparation of next phase		20,000	
5	Technology Dissemination Workshops		25,000	
6	Contingencies (10%)		33,500	

	PHASE-II – HCFC PILOT PHASEOUT PROJECT COVERING ALL APPLICATIONS (these costs are tentative and not part of the current funding request)			
1	System House adaptations 1 Blender 1 Tank for MeF Safety measures Contingencies (10%)	 50,000 20,000 25,000 9,500	 104,000	
2	Continuous Operations (12) 12 Retrofits @ 15,000 12 Trial Programs @ 3,000 Contingencies (10%)	 180,000 36,000 21,600	 237,600	
3	Discontinuous Operations (3) 3 ex proof metering systems @ 15,000 3 ventilation units @ 25,000 3 sensor systems @ 15,000 3 grounding programs @ 5,000 Contingencies	 45,000 75,000 45,000 15,000 18,000	 198,000	
4	Peer review/safety audits		50,000	
5	Incremental Operating Costs		1,326,400	**1,916,000**

Annex-6 provides details and justifications.

UNDP requests at this stage a grant for the first phase of this project amounting to

US$ 368,500

10. ANNEXES

Annex 1: Implementation/Monitoring Plan
Annex 2: Overview of PU Applications
Annex 3: Overview of HCFC Replacement Technologies in Foams
Annex 4: Participating Enterprises
Annex 5: Detailed Cost Calculations
Annex 6: Transmittal Letter

ANNEX-1

IMPLEMENTATION/MONITORING

Following implementation schedule applies:

TASKS	2008	2009				2010			
	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Project Start-up									
MF Project Approval	X								
Receipt of Funds		X							
Grant Signature		X							
Management activities									
-Monitoring/oversight activities in place		X							
Phase-I									
-Procurement		X							
-Installation		X							
-System development	X	XX							
-System optimization		XX							
-System validation at system house		X	XX						
-Peer review/detailed design of phase- II			X						
-Approval phase-II				X					
- Technology Dissemination Workshop(s)				XX					
Phase-II									
-Prepare individual Implementation plans				X					
-Procurement				X					
-Installation/start-up					XX				
-Trials					XX				
-Certificates of Technical Completion (COCs)					XX				
-Handover Protocols (HOPs)						XX			
-Completion Report (PCR)							X		

MILESTONES FOR PROJECT MONITORING

TASK	MONTH*
(a) Project document submitted to beneficiaries	2
(b) Project document signatures	3
(c) Bids prepared and requested	3, 9
(d) Contracts Awarded	3, 9
(e) Equipment Delivered	4, 11
(f) Training Testing and Trial Runs	4, 12
(g) Commissioning (COC)	14
(h) HOP signatures	15
(1) Compliance Monitoring	17

* As measured from project approval

ANNEX-2

IDENTIFICATION OF ODS USERS
IN
THE FOAM INDUSTRY

Foundation and at the same time one of the largest challenges for a successful ODS phaseout program is a successful identification program of the users. There are different avenues to do so:

- **The use of customs information –** In countries that do not produce CFCs, these substances have to pass by definition the border and are subject to customs registration and inspection. The problem with CFCs for foam applications is that not all CFCs are imported as such but frequently preblended into polyol. Inclusion of these substances in customs registration and mandatory disclosure of CFC content is therefore a precondition for an effective identification program through customs. It is emphasized that identification of the importer alone is not sufficient. The importer may use distributors. Identification of distributors as well as the CFC-containing system users is required. This requires convincing the importer/distributor that such identification is in the best interest of itself and its customers.

- **The use of trade associations –** In many countries trade associations represent the interests of producers of certain application groups. Their cooperation has been crucial, for instance in Brazil, India, Indonesia and Pakistan. Cooperation of trade associations allows the use of existing data bases and has proven particularly successful for group projects.

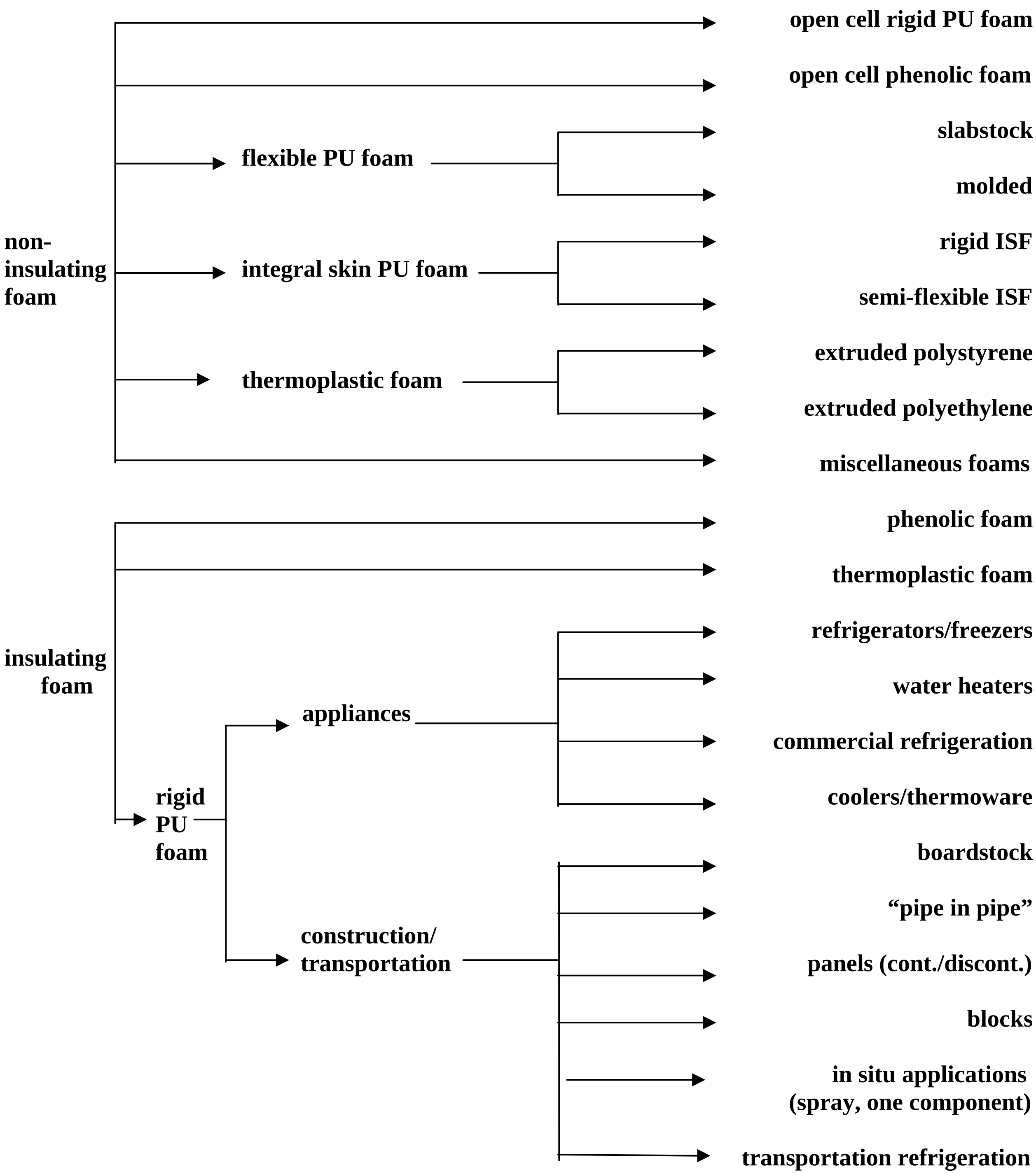
- **The use of local experts –** A person who is familiar with the local foam industry could accelerate and improve data collection. However, such person, after "picking his own recollection" is dependent on the same sources as any other data collector and dependent on persistence, ingenuity and organizational skills.

- **The use of already identified users –** This is an unstructured but amazingly effective method of identification. Many users are not interested in identification or even actively avoid meeting with Ozone Officers, mostly because of not knowing the benefits it may receive from joining the ODS phaseout program. The—positive—experience of a colleague/competitor may turn this opinion

- **The use of suppliers –** any foam producer needs chemicals for its production. Identifying the suppliers and their agents/distributors and enlisting their cooperation has proven to be one of the most successful tools in ODS user identification. Combined with a custom identification program and cooperation from other ODS users, it virtually assures a virtually complete user identification.

IT WILL BE A BENEFIT FOR THE OZONE OFFICER TO KNOW THE DIFFERENT FOAM APPLICATIONS. BY KNOWING THE STRUCTURE OF THE INDUSTRY AS WELL AS THE DIFFERENT APPLICATIONS THE CHANCE TO FINDS USERS AS WELL AS THE QUALITY OF THE PRE-ASSESSMENT INFORMATION CAN BE IMPROVED CONSIDERABLY.

Foamed plastics that are produced with CFCs can be classified on the basis of composition, chemical and physical characteristics, manufacturing process or application. They can be consolidated into **Non-Insulating Foams** and **Insulating Foams.** Insulation is understood in this context as thermal insulation. These main categories can then be further divided and subdivided into functional groups as follows:



The most prevalent use of **open cell rigid PUR foam** is for packaging applications ("pour in place" foam), mostly when small lots are involves, such as in the return of repaired items. Another application is "back-foaming" of crash panels, such as automotive dashboards.

Open cell phenolic foam is mainly used for flower arrangements.

Flexible PUR foam constitutes the largest group of non-insulating foams. Comfort applications, such as bedding and furniture, dominate in the use of **slabstock—continuous or boxfoam**—followed by lining for textiles. **Molded** foam is used in the automotive industry and, in much smaller amounts, for office furniture.

Rigid integral skin foams (ISFs) are used for recreational purposes, such as surf boards, and in imitation wood.

Semi-flexible ISFs are used in the automotive industry for arm rests and steering wheels, in office furniture and in shoe soles (micro-cellular).

Extruded polystyrene foam sheet is used for food packing applications (meat trays, egg cartons, plates, cups, etc). **Extruded polyethylene foam sheet and plank** is mostly used for packaging purposes.

Examples of **miscellaneous foams** are floor mats and one component foams, such as in spray canisters.

Closed cell **Phenolic foam** is used for building insulation.

Thermoplastic foams for thermal insulation purposes consist mostly of **extruded polystyrene insulation board** in construction applications and of **extruded polyethylene tubing** for pipe insulation.

Rigid PUR foams for thermal insulation are by far the most significant group of insulating foams. Its insulation value exceeds any other foam by a significant margin. There are numerous applications in appliances as well as construction.

In appliances, refrigerators dominate, but specifically in commercial refrigeration and small appliances, there is a diverse and frequently unexpected large use of foam. Examples are:

- Thermos bottles
- Water containers, cool boxes (fish industry!)
- Boilers
- Milk containers
- Casseroles/hot pots
- Vendor carts (ice cream, drinks)
- Insulated trucks
- Mortuary coolers

Examples of applications in construction are:

- Sprayfoam (chicken/hog farms, commercial buildings, cold storage)
- Roof panels
- Cold storage structural panels
- Pipe insulation

Examples of miscellaneous applications are:

- Floatation devices (buoys, surf planks)
- Boat filling (floatation as well as insulation)
- Bus insulation (thermal, sound)

ANNEX-3

HCFC PHASEOUT TECHNOLOGIES
IN
IN FOAM APPLICATIONS

I. INTRODUCTION

HCFCs are currently used in A2 countries as blowing agents in polyurethane (PU) foams (predominantly rigid and integral skin) and extruded polystyrene (XPS) boardstock foams. To replace these HCFCs, following criteria would ideally apply:

- A suitable boiling point with 25^0C being the target,
- Low thermal conductivity in the vapor phase,
- Non flammable,
- Low toxicity,
- Zero ODP,
- Low GWP,
- Chemically/physically stable,
- Soluble in the formulation,
- Low diffusion rate,
- Based on validated technology,
- Commercially available,
- Acceptable in processing, and
- Economically viable.

Not all replacement technologies that are currently available meet these criteria. Following assessment has been divided into the two applicable foam polymer groups: polyurethanes (PU) and (extruded) polystyrene (XPS) foams.

II PU FOAMS

CFC phaseout in rigid and integral skin foams has been mostly achieved by replacement through

- Hydrochlorofluorocarbons (HCFCs)
- Hydrocarbons (HCs)
- Carbon dioxide (CO_2), generated from water/isocyanate or directly as liquid or gas

HCFCs, in turn have already been replaced in many industrial countries by hydrofluorocarbons or HFCs which in the near future, in turn, may have to be replaced by other, non-ODS/low GWP alternatives. At the same time, suppliers are looking to reduce flammability and other safety-related issues. In the new compound, oxygen has been introduced to reduce GWP for HFCs, leading to HFOs (by some called second generation HFCs) or to reduce the flammability of HCs, leading to HCOs (esters, ethers, aldehydes and ketones). The identity of some new developments has not yet been released. But which makes the following scenario for now speculative—but compelling:

CO_2 ← CFCs → HCs
↓ ↓
HCFCs HCOs
↓
HFCs
↓
HFOs

In each column, the last step is non ODP, low GWP, low toxicity and reduced or eliminated flammability.

Using GWP and molecular data as provided by the FTOC (2006), following indicative GWP changes are to be expected for available or emerging replacements of HCFC-141b in PU foam applications:

SUBSTANCE	GWP	MOLECULAR WEIGHT	INCREMENTAL GWP[2]	COMMENTS
HCFC-141b	713	117	Baseline	
CO_2	1	44	-712	Used direct/indirect (from water)
Hydrocarbons	11	70	-710	Extremely flammable
HFC-245fa	1,020	134	455	
HFC-365mfc	782	148	276	Mostly used 95% pure
HFC-134a	1,410	102	516	
Methyl formate	0[1]	60	-713	97.5% pure (supplier information)
Methylal	0[1]	76	-713	Only reported for co-blowing
Acetone	n/k	58	n/k	Only used in flexible slabstock
FEA-1100	5	n/k	~700-710	Under development
HBA-1	<15	<125	<697	Under development
HBA-2	n/k	n/k	n/k	No published data yet
AFA-L1	<15	<134	>696	

[1]Zero GWP is not possible. Negligible would be a better description
[2]It should be noted that the incremental GWP is the effect expected based on 100% HCFC 141b replacement by just one alternative on an equimolecular base. In practice this will not always be the case. Formulators may increase water, reducing in this way the GWP impact—but also decreasing the foam quality—or use a blend of physical blowing agents. In addition, replacements are not always equimolecular as solvent effects, volatility and even froth effect (HFC-134a and to a lesser extent HFC-245fa) may impact the blowing efficiency. The table therefore provides a guideline rather than an absolute assessment.

These technologies are described in more detail below.

CARBON DIOXIDE

The use of carbon dioxide derived from the water/isocyanate chemical reaction is well researched. It is used as co-blowing agent in almost all PU foam applications and as sole blowing agent in many foam applications that have no or minor thermal insulation requirements. The exothermic reaction restricts the use, however to about 5 php and therefore to foams with densities >23 kg/m^3. While this restriction mostly applies to open-cell flexible foams which do not use HCFCs, another restriction based on the relatively emissive nature of CO_2 in closed-cell foam is more serious. To avoid shrinkage, densities need to be relatively high which has a serious detrimental effect on the operating costs up and above the poor insulation value. Nevertheless increased use of water/CO_2 has been and still is an important tool in the HCFC phaseout in cases where HCs cannot be used for economic or technical reasons. There is no technological barrier. However, the use of water/CO_2 alone will be limited to non-insulation foams such as

- Integral skin foams (with restrictions when friability is an issue)
- Open cell rigid foams
- Spray/in situ foams for non/low thermal insulation applications

Carbon dioxide can also be added directly as a physical. This is mostly the case in flexible foam and therefore not an HCFC replacement. However, reportedly (FTOC, 2008), there is use of super-critical CO_2 in up to 10% of all sprayfoam applications in Japan. Technical details are not known. Supercritical CO2—as has been the case with LCD in CFC phaseout projects—is a demanding and expensive technology and its usefulness in A5 projects questionable.

HYDROCARBONS

There have been many HC-based/MLF-supported CFC-phaseout projects in refrigeration and in panel applications. The minimum economic size has been typically ~50 ODP t/US$ 400,000 US$ with some exceptions for domestic refrigeration. Smaller projects were discouraged. Consequently, there is no use of HCs in SMEs. In addition, the technology was deemed unsafe for a multiple of applications such as spray and in situ foams. Generally, cyclopentane has been used for refrigeration and n-pentane for panels. Fine tuning through HC blends (cyclo/iso pentane or cyclopentane/isobutane) which are now standard in non-A5 countries is not widely spread in A5's. Consequently, the investment costs are the same as at the time of phasing out CFCs and the technology will continue to be too expensive for SMEs and restricted to the same applications as before. However, there are options to fine-tune project costs and investigate other applications:

- The introduction of HC blends that will allow lower densities (lower IOCs)
- Direct injection (lower investment)
- Low-pressure/direct injection (lower investment)
- Centralized preblending by system houses (lower investment)
- Application-specific dispensing equipment

UNDP has initiated a study of these options. After a feasibility study on each option, validation projects may be formulated with recipients that are capable and willing to participate. After completion of this preliminary study the costs of validation project can be calculated.

HFCs

There are currently three HFCs used in foam applications. Following table includes their main physical properties:

	HFC-134a	HFC-245fa	HFC- 365mfc
Chemical Formula	CH_2FCF_3	$CF_3CH_2CHF_2$	$CF_3CH_2CF_2CH_3$
Molecular Weight	102	134	148
Boiling point (^{0}C)	-26.2	15.3	40.2
Gas Conductivity (mWm^{0}K at 10 ^{0}C)	12.4	12.0 (20 ^{0}C)	10.6 (25 ^{0}C)
Flammable limits in Air (vol. %)	None	None	3.6-13.3
TLV or OEL (ppm; USA)	1,000	300	Not established
GWP (100 y)	1,410	1,020	782
ODP	0	0	0

Current HFC use in A5 countries is insignificant. There is some use of HFC-134a in shoesoles—most notable in Mexico. Apart from the price, its use is complicated by its low boiling point. The use of other HFCs is limited to products for export—and even then sporadic. The low cost of HCFC-141b is just too compelling! On the other hand, these chemicals have played a major role in the replacement of HCFCs in foam applications in non-A5 countries—despite high GWP potentials.

Formulations are not straightforward molecular replacements. Generally, the use of water has been maximized and sometimes other co-blowing agents have been added. Therefore, an assessment of its environmental impact has to be based on actual, validated, commercial blends. UNDP has initiated a "clima proof" study based on blends proposed by chemical suppliers of HFC-245fa and HFC-365mfc. A recently developed "functional unit" approach—a simplified life cycle test will be applied in this study.

This approach has been described in some detail in UNEP/Ozl.Pro/ExCom/55/47. It is robust enough to meet Decision XIX requirements—addressing both energy and GWP—but does not require the individualized approach of full life cycle analyses. It would not only provide for a fair assessment of optimized HFC formulations but also demonstrate the use of the "Functional Unit" approach and facilitate the Secretariat's evaluation as requested by the ExCom in decision 55/43 (h). The assessment will be a desk study. It has not to be tied to a specific country and will be universally (globally) applicable.

METHYL FORMATE (ECOMATE®)

Methyl-formate, also called methyl-methanoate, is a low molecular weight chemical substance that is used in the manufacture of formamides, formic acid, pharmaceuticals, as an insecticide and, recently, as a blowing agent for foams. While its use as blowing agent for synthetic rubbers is reported in earlier literature, Foam Supplies, Inc. (FSI) in Earth City, MO has pioneered its use as a blowing agent in PU foams from 2000 onwards. The application has been patented in several countries. Presentations by FSI have been made at major PU conferences and to Foam Technical Options Committee (FTOC 2006).

Ecomate®, as FSI calls the product, is exclusively licensed to Purcom for Latin America, to BOC Specialty Gases for the United Kingdom and Ireland and to Australian Urethane Systems (AUS) for Australia, New Zealand and the Pacific Rim. Reportedly, AUS has also acquired the license for other Asian countries such as India and China. Technical and commercial claims made by FSI imply that the technology actually would reduce operating costs when replacing HCFC-141b, at minimum capital investment and comparable or better quality. This, of course would be of utmost interest for the MLF and its Implementing Agencies. However, these claims need to be verified and validated by an independent body before the technology can be applied in MLF projects. In case insufficient data are provided, additional data will have to be developed. Ecomate® has been mentioned in a preliminary discussion paper for the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol (UNEP/Ozl.Pro/ExCom/54/54). The information, while qualified as being provided by the supplier, is used to develop data on investment cost and operating benefits that are displayed together with data from technologies that have been extensively verified and validated in CFC phaseout projects and generates therefore the appearance of reliability. There is, however, market information that clearly contradicts this information and UNDP's conclusion—apparently shared by the FTOC—is that ecomate® technology is interesting and promising but immature, unproven in many foam applications and at this stage more expensive than HCFC-141b—and for that matter, hydrocarbons. Better, peer-reviewed data are urgently required if this technology is to be used in MLF projects.
Following data on physical properties have been taken from the FTOC-2006 and from a BOC MSDS:

Property	Methyl Formate	HCFC-141b
Appearance	Clear liquid	Clear liquid
Boiling point	31.3 °C	32 °C
LEL/UEL	5-23 %	7.6-17.7
Vapor pressure	586 mm Hg @ 25 °C	593 mm Hg @ 25 °C
Lambda, gas	10.7 mW/m.k @ 25 °C	10.0 mW/m.k @ 25 °C
Auto ignition	>450 °C	>200 °C
Specific gravity	0.982	1.24
Molecular weight	60	117
GWP	0	630
TLV (USA)	100 ppm TWA/150 ppm STEL	500 ppm TWA/500 ppm STEL

According to information from FSI, ecomate® has the following advantages compared to HCFC-141b when used in foam manufacturing (only those important under A5 conditions are listed):

- Liquid at ambient process conditions
- Zero ODP
- Zero GWP
- Lower IOCs
- Good solubility
- Low volatility
- Good system stability
- Good foam properties
- Good thermal insulation properties
- Good flammability resistance
- Safe handling

FSI does not mention actual system costs; it claims the technology being "*economically advantageous*". It relates this to being more effective—51% of HCFC-141b. Total costs are indicated as follows:

Blowing Agent	Mol Wt	Factor	US$/Lb	US$/mole
HCFC-141b	117	1.00	++	Ref
HFC-245fa	134	1.15	+++++	+350%
HFC-365/227	149	1.27	++++	+380%
cC5	70	0.60	++	- 45%
nC5	72	0.62	+	- 70%
ecomate®	**60**	**0.51**	++	- 65%

In the USA, Ecomate® is not treated as a volatile organic component (not a smog generator) and SNAP approved. In Europe it is compliant with the RoHS and WEEE directives. Acute toxicity is reported low with no special hazards. The MSDS mentions R12 (extremely flammable but not explosive); R20/22 (harmful by inhalation and if swallowed) and R36/37 (irritating to eyes and respiratory system).

The IPCS profile mentions in addition that "*vapor/air mixtures can be explosive*". FSI reports a case study that shows process emissions to be lower than 100 ppm, which is less than the STEL and TWA and therefore would require no special precautions in the manufacturing area. Ecomate® is normally sold as a system, which would restrict flammability issues to the supplier. Shipping of systems is possible without "flammable" tags.

As applications for ecomate®, FSI is mentioning

- Rigid pour and spray foams,
- Integral skin foams, and
- Flexible molded and slabstock foams.

Reportedly, Brazil is the only A5 country where ecomate® is used. The licensee for Latin America, a large system house, was contacted for more information. The company stated that they have spent much efforts in system development for ecomate® which has by now replaced about one third of their HCFC business. Current commercial applications (which indicates mature product) are in integral skin foam (steering wheels), panels (discontinuous) and commercial refrigeration (bottle coolers; refrigerator doors). Because the technology is more costly than HCFC-141b (about 10%), customers use it only when the market demands it. This is the case for international corporations such as Coca Cola and for construction on behalf of international corporations (Wall Mart, Carrefour, …).

Following information was provided and verified through customer visits:

Health, Safety, Environment – The licensee has not developed any data in addition to what FSI provides. It has not encountered HSE problems in its manufacturing plant or at customer level. This was confirmed through the two customer visits.

Performance in Thermal Insulation Foams – The licensee has measured (through independent testing) some deterioration in insulation value. Amazingly, one of its main customers—a major bottle cooler manufacturer—did not find any increase in power consumption and the product has been approved by Coca Cola. However, the customer produces ecomate® on its only high-pressure dispenser to take advantage of increased thermal performance provided by the smaller, more regular cells. The customer mentioned as positive point that ecomate® does not attack the refrigerator liner and that it could return to its pre-HCFC-141b, liner (an operational benefit!). Adhesion to metal liners is markedly improved. A refrigerator cabinet could not be stripped from foam without leaving considerable material on the liner. This is an improvement in particular to HC-blown foams. Purcom had to considerably reformulate by changing polyols, catalyst package and stabilizer. The amount of methyl formate that can be used is limited, which results in the need to increase water levels. The costs of ecomate® is US$ 3.00/kg compared to US$ 2.00/kg for HCFC-141b but its use is 1/3-1/2 less (the use of HCFC-141b actually reduces system costs as the price is lower than the polyol price). The resulting system costs about 10% more and produces foams that are slightly higher in density (1-2 kg/m^3). Because of the price/density impact (about 10%), companies use ecomate® only when customers demand replacement of HCFC-141b. 3They all use HCFC-141b in other cases.

Performance in Integral Skin Foams – the licensee initially faced stability problems in the polyol side of the system and inferior skin that made the application for steering wheels—which requires low friability—a problem. The reason was the addition of formic acid to counter hydrolysis. Without stabilization, the polyol system is stable for just one day. It identified two options for improvement:

- Direct injection of methyl formate
- Incorporation of methyl formate in the MDI side

As most equipment is not equipped for a third stream it concentrated on the MDI option and was able to develop a stable system providing good skin, same density BUT, a considerably decrease in viscosity of the MDI side of the system. This is no issue for high-pressure dispensing equipment but causes ratio changes on low-pressure equipment. The ecomate® use is about two third of HCFC-141b and the polyol blend had to be changed drastically.

Performance in Other Applications – There is currently no use of ecomate® in other applications. Its use is at the moment customer rather than supplier driven. Large, international, image-sensitive corporations demand ODS-free, low GWP products. Consequently, the licensee has only pursued ecomate® when and where customer pressure has been exercised and will continue to do so unless some MLF-sponsored introduction program would be initiated.

Naturally, the physical properties of ecomate®, being nothing else than the long existing and well researched chemical methyl formate, are not controversial. UNDP has compared information provided by the owner of the technology, FSI, with actual (limited) experience from customers and its LA licensee. Following are detailed comments on the advantages claimed by FSI for ecomate®:

- **Zero ODP –** true, but so area all other listed alternatives
- **Zero GWP** – true, although negligible would be a better description
- **Liquid at ambient process conditions –** true, but so are most other listed alternatives

- **Good solubility** – this claim is appears correct and is confirmed for most polyols and MDI. However, why is the MSDS mentioning "*not miscible or difficult to mix*" (MSDS)?
- **Low volatility** – the volatility is about in the middle between other alternatives, with HFC-245fa being the highest (bp 15.3 ^{o}C) and cyclopentane the lowest (bp 49 ^{o}C)
- **Good foam properties** – this statement is too broad and, as yet, unproven for major applications. Based on results from applications where intensive formulation optimization has been performed, there should be some confidence that most property issues can be resolved given time and dedication
- **Good thermal insulation properties** – this is as of yet unproven. Tests on foam insulation values in Brazil are not good but product testing will be decisive in final determination
- **Good flammability resistance** – this statement has not yet been verified. However, information provided (Utech, 2006) lacks information on comparative testing
- **Safe handling** – handling issues at the system house—where industrially pure methyl formate (97.5%) is processed needs further investigation. Information on the handling of systems indicates safe processing conditions with <22%LEL @ 30-32 ^{o}C; <100 ppm LEL
- **Good system stability** – while rigid foam systems appear to be stable, polyol/ecomate systems for ISF are instable in Brazilian tests
- **Lower IOCs** – this claim cannot be confirmed. From experience in ISF and rigid insulation foams in Brazil, 10-15% increase in system costs at current level of development can be expected compared to HCFC-141b. Compared to hydrocarbons, the difference is even larger. And, this statement even has to be qualified as preliminary because it pertains only to certain applications within the broader range of products and formulation optimization proves to be rather individually

While one cannot emphasize enough that ecomate® should be considered a highly interesting, potential financially beneficial, zero ODP and virtually zero GWP technology for MLF-sponsored HFCF phaseout projects, the information provided by the technology provider does not always match field experience and is, in addition, incomplete. UNDP intends to collect further validation information through:

- HSE testing
- Validation of ecomate® in all relevant applications

METHYLAL

METHYLAL

Methylal, also called dimethoxymethane, belongs to the acetyl family. It is a clear colorless, chloroform-like odor, flammable liquid with a relatively low boiling point. Its primary uses are as a solvent and in the manufacture of perfumes, resins, adhesives, paint strippers and protective coatings. It is soluble in three parts water and miscible with the most common organic solvents.

Property	Methylal	HCFC-141b
Appearance	Clear liquid	Clear liquid
Boiling point	42 ^{o}C	32 ^{o}C
LEL/UEL	2.2-19.9 %	7.6-17.7
Vapor pressure	400 mm Hg @ 20 ^{o}C	593 mm Hg @ 25 ^{o}C
Lambda, gas	Non available	10.0 mW/m.k @ 25 ^{o}C
Auto ignition	235 ^{o}C	>200 ^{o}C
Specific gravity	0.821 @ 20 ^{o}C	1.24
Molecular weight	76.09	117
GWP	Negligible	630
TLV (USA)	1000 ppm TWA	500 ppm TWA/500 ppm STEL

The use of Methylal as a co-blowing agent in conjunction with hydrocarbons and HFCs for rigid foam applications (domestic refrigeration, panels, pipe insulation and spray) has been described in the literature. It is claimed that in continuous panels Methylal improves the miscibility of pentane, promotes blending in the mixing head, foam uniformity, flow, adhesion to metal surfaces and insulation properties, reducing simultaneously the size of the cells. In discontinuous panels, where most producers use non-flammable agents, the addition of a low percentage of Methylal to HFCs (245fa, 365mfc or 134a) makes it possible to prepare pre-blends with polyols of low flammability with no detrimental effect on the fire performance of the foam. Methylal reduces the cost, improves the miscibility, the foam uniformity and flow and the adhesion to metal surfaces. Co-blown with HFC-365mfc, it also improves the thermal insulation. In domestic refrigeration compared to cyclopentane alone Methylal increases the blowing rate and the compressive strength. In spray foam it reduces the cost of HFC-245fa or HFC-365mfc.

Here is no known use of methylal as sole auxiliary blowing agent.

Despite all literature references, public knowledge of Methylal's industrial performance as blowing agent is quite limited. To validate its use as a possible replacement of HCFCs for MLF projects in developing countries, peer reviewed evaluations should be carried out to assess its performance in integral skin and rigid insulating foams. Following parameters should be carefully monitored:

- Fire performance in actual operating conditions (considering flammability of the pure chemical)
- Polyol miscibility, an advantage claimed in the literature
- Foam flow (taking into account the relatively high -compared to other blowing agents- boiling point)
- Foam thermal conductivity (Gas conductivity value is not reported)
- Skin formation. (A cited US patent suggests a clear benefit)
- Diffusion rate in the polyurethane matrix (in view of its high solvent power)

EMERGING TECHNOLOGIES

Since early 2008, a flood of new blowing agents for PU foams have been proposed by major international manufacturers of halogenated compounds. Four of them are worth mentioning. These are all geared towards replacement of HFCs and sometimes called "second generation HFS, although HFOs appears a more distinctive description. They share low/no flammability, zero ODP and insignificant GWPs:

	HBA-1	HBA-2	FEA-1100	AFA-L1
Chemical Formula	n/k	n/k	n/k	n/k
Molecular Weight	<125	n/k	161-165 (estimated)	<134
Boiling point (^{0}C)	<-15	n/k	>25	>10 <30
Gas Conductivity (mWm^{0}K at 10 ^{0}C)	13	n/k	10.7	10
Flammable limits in Air (vol. %)	None	None	None	None
TLV or OEL (ppm; USA)	1,000 (proposed)	n/k	n/k	n/k
GWP (100 y)	0	0	0	0
ODP	6	n/k	5	Negligible

Except HBA-1, all chemicals still have to undergo substantial further toxicity testing and will therefore not appear in the market within two years. That may be too late in the A5 context where foam conversion is prioritized. As to HBA-1, this will be targeted as a replacement of HFC-134a in one component foams. There are only few OCF manufacturers in developing countries.

III XPS BOARDSTOCK

Extruded polystyrene foam can be divided into sheet and boardstock applications. In virtually all sheet applications CFCs have been replaced by hydrocarbons—butane, LNG and LPG. In boardstock, most of the replacement has been a blend of HCFC-142a and HCFC-22 in a 70-80%/30-20% ratio. The use of HCFC-22 was aimed at countering HCFC-141b's (modest) flammability. With the prices of HCFC-22 ever decreasing, many manufacturers—mainly in China—have converted to HCFC-22 alone. This has exacted an as of yet undetermined toll on the product quality as HCFC-22 escapes relatively quick from the foam, causing shrinkage and deteriorating insulation values.

The 2008 FTOC update reports that the phaseout of HCFCs in non Article 5 countries has been—and continues to be—a problem. North American XPS boardstock producers are on course to phaseout HCFC use by the end of 2009. Phaseout choices will be HFC blends, CO_2 (LCD) and hydrocarbons. The significant variety in products required to serve the North American market (thinner and wider products with different thermal resistance standards and different fire-test-response characteristics) will result in different solutions than in Europe and Japan, who have already phased out HCFCs. In Europe, this has been achieved with HFC-134a, HFC-152a and CO_2 (or CO_2/alcohol) while in Japan there has also been significant use of hydrocarbons. Recently introduced so called F-Gas regulations in Europe may change the scenario in that region.

Most XPS boardstock manufacturing in Article 5 countries appears to be in China (60,000t) and Turkey (10,000 t). There is at least one plant in Argentina and one in Egypt. This application has not been well researched by the TEAP because it was traditionally a non-A5 market. But now only in China, approximately 350 small-scale XPS plants have been installed since 2001.

Options for HCFC replacement are:

SUBSTANCE	COMMENTS
HFC-134a	Considered expensive
HFC-152a	Moderately flammable and considered expensive
(Iso)butane	Highly flammable; high investment
CO_2	As gas only capable to replace 30% of the BA. As liquid, high investment. Considered in combination with other technologies (HCs, ethanol)
HBA-1	Non-flammable, ideal boiling point, but still experimental

There may be different solutions for different baselines. In view of the fact that Chinese manufacturers are reported using only HCFC-22 as blowing agent, it is expected that 100% replacement by a hydrocarbon would be possible without (further) deterioration of quality. This would provide the Chinese market with a truly non-ODS, virtually non-GWP option. However, the emission of hydrocarbons over an extended period is of concern, being different from XPS sheet. Therefore, as part of a validation, a thorough safety assessment will need to be performed.

Very important will be to evaluate the possible use of HBA-1. This substance appears to offer the same advantages of hydrocarbons without the fire risk and to offer improved insulation value compared with other HCFC replacements. But, with no diffusion data available, this is a very preliminary statement. UNDP is in contact with its manufacturer, Honeywell, which has in principle agreed to support a validation project. Details need to be worked out.

Using GWP and MW data as provided by the FTOC (2006), following indicative GWP changes are to be expected for the replacement of HCFC-141b in PU foam applications:

SUBSTANCE	GWP	MOLECULAR WEIGHT	INCREMENTAL GWP	COMMENTS
HCFC-142b/-22	2,148	95	Baseline	
HCFC-22	1,780	87	-518	Used in China only (lower cost) Non flammable
HFC-134a	1,410	102	-634	Non flammable
HFC-152a	122	66	-2,063	Moderately flammable
(Iso)butane	4	58	-2,156	Flammable
CO_2 (LCD)	1	44	-2,148	Used in Japan only Non Flammable
HBA-1	6	<115	~ 2,100	In development Non flammable

Based on these data, it appears that

- HCs, CO_2 (LCD) and HBA-1 are by far the lowest GWP—indeed virtually zero ODP—options
- HFC-152a's GWP is below the EU threshold of 150. It may therefore be an acceptable alternative from a clima change perspective

The XPS boardstock program may therefore include:

- HFC-152a
- Hydrocarbons
- Carbon Dioxide (gas or liquid)
- HBA-1

ANNEX-4

PARTICIPANTS AND BASELINE DATA TEMPLATE

APPLICATION	ENTERPRISE	CONSUMPTION (t/y)					
		SYSTEMS			HCFC-141b		
		2005	2006	2007	2005	2006	2007
FLEXIBLE FOAMS (FPF)							
Hyper-soft Slabstock	Client 1	16	20	24	2.4	3.0	3.6
Hyper-soft Molding	Client 2	7	7	7	1.1	1,1	1.1
Low Resilience Slabstock	Client 3	120	120	120	7.2	7.2	7.2
INTEGRAL SKIN FOAMS (ISF)							
Rigid ISF	Client 4	150	160	165	16.5	17.6	14.0
Flexible ISF	Client 5	120	142	150	14.0	17.0	18.0
RIGID INSULATION FOAMS (RPF)							
Domestic Refrigeration	Client 6	94	100	110	14.0	15.0	16.0
Commercial Refrigeration	Client 7	1,000	1.100	1,200	150.0	165.0	180.0
Water Heaters	Client 8	30	32	35	4.5	4.8	5.2
Panels, Continuous	Client 9	900	1,000	1,200	125.0	130.0	160.0
Panels, Discontinuous	Client 10	150	150	168	20.8	22.2	23.0
Trucks	Client 11	180	200	280	25.0	27.8	39.0
Blocks	Client 12	30	30	36	4.2	4.2	5.0
Pipe-in-Pipe	Client 13	120	150	180	16.8	21.0	25.0
Thermoware	Client 14	90	100	110	13.5	15.0	16.5
Spray	Client 15	400	420	450	60.0	63.0	71.0
TOTAL		**3,407**	**3,731**	**4,235**	**413.0**	**513.9**	**584.6**

ANNEX-5

DETAILED COST CALCULATIONS FOR PHASE-1

#	ACTIVITY	COSTS (US$)	EXPLANATIONS
1	Preparative work Project Preparation Technology Transfer, Training	 30,000 25,000	 Partially retroactive for UNDP-funded preparation/TTT
2	System Development Development (7 applications) @ 5,000 Optimization (16 applications) @ 3,000 Validation (16 applications) @ 2,000	 35,000 48,000 33,000	 Does not included labor—just chemicals and external testing
3	Laboratory Equipment Laboratory Safety	140,000 10,000	See below For explosion proofing
4	Technology Dissemination Workshop	25,000	
5	Peer review/endorsement of next phase	20,000	
6	Contingencies (10%)	36,500	

ESTIMATED COST CALCULATIONS For PHASE II
(to be recalculated after technology validation)

1	System House adaptations 1 Blender 1 Tank for MeF Safety measures Contingencies (10%)	 50,000 20,000 25,000 15,000	)))Taken from previous projects)
2	Continuous Operations (12) 12 Retrofits @ 15,000 12 Trial Programs @ 3,000 Contingencies (10%)	 180,000 36,000 21,600	))As per MLFS template)
3	Discontinuous Operations (3) 3 ex proof metering systems @ 15,000 3 ventilation units @ 25,000 3 sensor systems @ 15,000 3 grounding programs @ 5,000 Contingencies	 45,000 75,000 45,000 15,000 18,000	)))From previous projects))
4	Peer review/safety audits	50,000	10 days/15 visits/travel/per diem
5	Incremental Operating Costs	1,326,400	See below

Laboratory equipment	K-factor tester	US$	10,000
	Refractometer		5,000
	Brett mold		5,000
	HP laboratory dispenser		50,000
	Sprayfoam/PIP dispenser		20,000
	pH tester		5,000
	Abrasion tester		25,000
	Cell gas analyzer		20,000
	Total	**US$**	**140,000**

Incremental operating costs are based on 10% increased polyol system costs, which amounts to ~5% increase in total chemical costs as per Purcom information. For 2 years/net present value base, this amounts to 10% of 4,235 t @ 3,600 x 1.74 = **US$ 1,326,400.**

ANNEX-6

TRANSMITTAL LETTER

SUBMISSION OF A PILOT PROJECT FOR FUNDING UNDER THE MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL[1]

Systems House Commitments

PURCOM, represented by Mr. Gerson Silva, Director having agreed to the preparation of a project for the consideration of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol to validate the use of methyl formate as replacement of HCFC-141b in the manufacture of polyurethane foams following and in compliance with ExCom decision 55/43 (e), makes the following commitments for the implementation of the project with the assistance and in cooperation with the United Nations Development Programme (UNDP) and with the consent of the Government of Brazil's National Ozone Unit (NOU).

PURCOM:

1. Agrees to implement the project as approved, abiding by relevant decisions relating to change in technology;

2. Is aware that a validation project does not have a secure outcome. In case the validation is successful, it will participate in the permanent conversion of participating customers to the use of methyl formate;

3. Is aware and accepts that, with the view to ascertaining that equipment purchased by the Multilateral Fund is being used or is not reverted to the use of HCFCs, the NOU is mandated to monitor closely in cooperation with customs and environmental protection and/or other relevant authorities, the importation and or purchase and use of HCFCs by the enterprise, including unscheduled visits to the factory. The enterprise and the NOU may determine the number of such unscheduled visits.

4. Is aware that the implementing agency has the obligation to ensure appropriate use of or refund of unused contingency funds and to keep funding requests for equipment and trials to levels essential for the conversion;

5. Will cooperate in the preparation of regular reports through UNDP and the NOU to the Multilateral Fund on the status of the project's implementation;

6. Agrees to cooperate with the implementing agency to return funds in case of identified serious funding irregularities, such as when project funds were used to purchase non-eligible items and the implementing agency was requested by the Executive Committee to return funding to the Multilateral Fund;

7. Is aware and accepts that the implementing agency in cooperation with the NOU is required to conduct safety inspections where applicable and to prepare a report on accident resulting from conversion projects.

8. Commits to destroy or render unusable any equipment or component of equipment replaced by this project in line with the stipulations that have been drawn up in the project document.

---

[1] *This note should be prepared on company letter head and attached as Annex I to each project document. A copy should be lodged with the NOU to be appended to its record of the Government's Note of Transmittal of the sector projects.*

9. Commits to provide funds for items that are included in this project but are specifically excluded from funding by the Multilateral Fund of the Montreal Protocol (MLF) as well as for items included in this project and required for a successful completion but that, while eligible, exceed the available budget and contingencies.

Name and Signature of Authorized Enterprise Representative:

____

Designation: Date:

____

____

Address: ____

____

Telephone: __________________ Fax: __________________

E-mail: ____

Name and Signature of Representative of NOU Date:

____