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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Twenty-third Meeting
Montreal, 12-14 November 1997

PROJECT PROPOSALS: THAILAND

This documents includes the comments and recommendations of the Fund Secretariat on the following project proposals:

Aerosol

• J.M.T. Laboratories Co. Ltd. conversion	UNDP
• P-Tech Manuchem Co. Ltd. conversion	UNDP

Foam

• Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (thermoware) at Century Plastics	UNDP
• Conversion to CFC-free technology in the manufacture of flexible slabstock polyurethane foam (boxfoam) at Thai International	UNDP
• Conversion to CFC-free technology in the manufacture of flexible polyurethane boxfoam at Nun Charoen	UNDP
• Conversion to CFC-free technology in the manufacture of integral skin polyurethane foam at Novochem	UNDP
• Conversion to CFC-free technology in the manufacture of flexible slabstock polyurethane foam at Chareon Porn	UNDP

• Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers) at Viriyakit Plastic Industry Co. Ltd.	World Bank
• Conversion to CFC-free technology in rigid spray foam applications at P.U. Foam Insulation and Trading Co. Ltd.	World Bank
• Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (thermoware) at Siam Chaicharoen Industry Co. Ltd.	World Bank
• Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers) at Treatthaboon Industry Co. Ltd	World Bank
• Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (thermoware) at General Injection Co. Ltd.	World Bank
• Conversion to CFC-free technology in rigid sprayfoam applications at Thermobond Co. Ltd.	World Bank
• Conversion to CFC-free technology in the manufcture of rigid polyurethane foam (containers) at Can Asia Products Co. Ltd.	World Bank
• Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (panels) at Alcan Nikkei Thai Aluminum Co. Ltd.	World Bank

Refrigeration

• Building chiller replacement program to reduce the usage of CFC-11 and CFC-12 in chiller servicing at Electricity Generating Authority of Thailand (EGAT)	World Bank
• Elimination of ODSs used in the production of household refrigerators at Hitachi Consumer Products (Thailand) Co. Ltd.	World Bank
• Conversion of CFC-12 commercial refrigeration to HC-134a, and CFC-11 to HCFC-141b as the blowing agent for foam insulation at Padriew Co. Ltd.	World Bank
• Conversion of CFC-12 commercial refrigeration to HFC-134a, and CFC-11 to HCFC-141b as the blowing agent for foam insulation at Sahakarn Intercool Co. Ltd.	World Bank
• Conversion of CFC-12 refrigerant to HFC-134a, and CFC-11 to HCFC-141b as the blowing agent for foam insulation in the manufacture of Water Coolers at Siam Cooler	World Bank
• Conversion of CFC-12 refrigerant to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation in the manufacture of water coolers at Sirithana	World Bank

PROJECT EVALUATION SHEET
THAILAND

SECTOR: AEROSOLS ODS use in sector (1992): 600 ODP tonnes

Sub-sector cost-effectiveness thresholds: Aerosol US $4.4/kg

Project Titles:
(a) Phasing out CFCs at JMT Laboratories
(b) Phasing out CFCs at P-Tech Manuchem Co. Ltd Conversion

Project Data	**Aerosols**	
	JMT Laboratories	P-Tech Manuchem Co.
ODS phase-out (ODP tonnes)	36.6	37.3
Proposed project duration (months)	12	12
Incremental capital cost (US $)	169,440	160,581
- including contingency (%)	10	10
Incremental operational cost (US $)	(8,370)	(11,193)
Total project cost (US $)	161,070	149,388
Local ownership (%)	100	100
Export component (%)	0	0
Amount requested (US $) {Original}	161,070	149,388
{Revised}		
Cost effectiveness (US $/kg)	4.40	4.04
National Coordinating Agency	Department of Industrial Works	
Implementing Agency	UNDP	
Technical review completed?	Yes	Yes

Secretariat's Recommendations:		
Amount recommended (US $)	127,920	115,830
Project impact (ODP tonnes)	36.6	37.3
Cost effectiveness (US $/kg)	3.49	3.10
Implementing Agency support cost (US $)	16,630	15,058
Total cost to Multilateral Fund (US $)	144,550	130,888

PROJECT DESCRIPTION

(a) Phasing out CFCs at JMT Laboratories
(b) Phasing out CFCs at P-Tech Manuchem Co.

1. In 1992, the total consumption of CFCs in the aerosol sector in Thailand amounted to 600 tonnes. The Executive Committee approved at its 17th Meeting two projects for the phase out of 349 tonnes of CFCs used in the manufacturing of aerosol products at Sanit and Sons Co., and Packserve Co.

2. The Government of Thailand is submitting two additional projects which would lead to elimination of 73.9 tonnes of CFCs, namely, JMT laboratories (36.6 tonnes of CFCs) and P-Tech Manuchem (37.3 tonnes).

3. In total, 422.9 tonnes of CFCs would be eliminated once all the projects become operational, equivalent to 70 per cent of the CFC consumption in the sector. The project proposals state that "the ODS consumption for 1995 and 1996 are 8,779 and 6,041 ODP tonnes, respectively. It is estimated that ODS consumption in 1997 will be the average of 1995 and 1996 at 7,420 ODP tonnes. Therefore, the average annual consumption for the three year 1995, 1996, 1997 will be 7,420 ODP tonnes. Forecast consumption in 1999, based on unconstrained demand and 6% GDP annual growth rate using 1997 as the starting point, would lead to an estimated consumption of 8,337 ODP tonnes. In order to meet the obligation of the Montreal Protocol in 1999, Thailand must eliminate at least 917 ODP tonnes per annum. Approval of these project proposals would eliminate some 73.9 ODP tonnes and make a significant contribution to enable Thailand to meet its obligations under the Montreal Protocol commencing in 1999".

4. The projects under consideration are for the replacement of CFCs with hydrocarbon propellant used in manufacturing different types and sizes of aerosol products. JMT Laboratories produces hair sprays and conditioners (0.33 million cans/year) and P-Tech Manuchem produces deodorant, hair spray, gel spray, styling mousse and air refresher (0.372 million cans/year), both as contract filler and for their own brand.

5. JMT Laboratories have already started conversion to hydrocarbon technology. However, the enterprise is still using CFC propellant. Conversion entails replacement of the filling machine, a manually operated hot water bath system and a conveyor. The enterprise is requesting retroactive compensation for the hydrocarbon storage and handling systems that have already been installed.

6. P-Tech Manuchem will convert to hydrocarbon technology. Conversion entails replacement of the two existing semi-automatic filling machines and a manually operated water bath for testing filled cans.

7. Technical assistance will be provided for performance and supervision of engineering designs, equipment installation and commissioning of the plant. Training in production, quality control and safety procedures will also be provided.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

1. The two projects considered by the Committee at its 17th Meeting were approved on the "condition that disbursement of Fund resources would occur only after the Government of Thailand has assured the Executive Committee that the policy and regulatory system in place would prevent other CFC aerosol fillers from expanding their current market share and that the use of CFCs in the aerosol sector in Thailand would be limited to the level of CFC consumption remaining after the reductions achieved as a result of these projects had been subtracted from currently reported consumption levels in this sector" (Decision 17/37). The Secretariat received an official communication from the Ministry of Industry stating that effective 24 March 1997, the Government "will not allow any aerosol companies/factories to produce aerosol cans using CFC substances any more".

2. The Fund Secretariat requested UNDP to provide more background information on the filling operations performed at the two enterprises, since both of them use CFC and LPG in their processes. UNDP informed the Secretariat that "both companies were experimenting with LPG for part of their production. The proposed projects would allow them to convert 100% of their production to LPG".

3. The Secretariat also discussed with UNDP the level of funding requested for some pieces of equipment (water baths, conveyors and filling system) and the issue of applying a contingency cost to equipment for retroactive funding. The costs of the projects were adjusted accordingly. Operational savings (NPV) for four years associated with the manufacture of their own brands were also considered: US $8,370 for JMT Laboratories and US $13,581 for P-Tech Manuchem.

4. JTM Laboratories have invested in new building facilities for filling cans and packing finished products to reduce plant congestion and to allow for a safe conversion. These costs were not included in the project.

5. Each project lists the baseline equipment, including brand name, capacity and date of purchase, to be destroyed once the conversion is completed.

RECOMMENDATION

1. The Fund Secretariat recommends blanket approval of the projects at the funding levels indicated below:

Project Title	Project Cost US $	Support Cost US $	Implementing Agency
(a) Phasing out CFCs at JMT Laboratories	127,920	16,630	UNDP
(b) Phasing out CFCs at P-Tech Manuchem	115,830	15,058	UNDP

PROJECT EVALUATION SHEET
THAILAND

SECTOR: FOAMS ODS use in sector (1991): 1510 ODP tonnes
Sub-sector cost-effectiveness thresholds: Rigid PU 7.83 US $/kg

Project Titles

(a) CAN ASIA - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers)
(b) SIAM CHAICHAROEN conversion to CFC-free technology in the manufacture of rigid polyurethane foam (thermoware)
(c) TREATHABOON - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers)
(d) VIRIYAKIT - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers)
(e) GENERAL INJECTION - conversion to CFC-free technology in rigid polyurethane foam (thermoware)
(f) THERMOBOND - conversion to CFC-free technology in rigid sprayfoam applications
(g) PU FOAM INSULATION AND TRADE - conversion to CFC-free technology in rigid sprayfoam applications
(h) NIKKEI THAI - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (panels)
(i) CENTURY PLASTICS - conversion to CFC-free technology in rigid polyurethane foam (thermoware)

Project Data	**Rigid PU Foam**								
	Can Asia	Siam	Treathaboon	Viriyakit	General Injection	Thermobond	Pu Foam	Nikkei Thai	Century Plastics
ODS (CFC-11) phase out (ODP tonnes)	16.81	11.3	22.7	27.5	15.4	10.4	58.1	43.5	7.25
Proposed project duration (months)	24	24	24	24	24	24	24	24	24
Incremental capital cost (US$)	93,500	110,000	116,000	71,500	105,000	27,500	121,000	61,000	53,000
- including contingency (%)	10	10	10	10	10	10	10	10	10
Incremental operational cost (US$)	23,500	21,000	83,500	71,200	28,500	57,000	104,400	80.0000	13,500
Total project cost (US$)	117,000	142,000	199,500	142,700	133,500	84,500	225,400	146,000	66,500
Local ownership (%)	100	100		100	100	100	100	100	100
Export component (%)									
Amount requested (US $) {Original}	100,000	88,500	177,750	164,700	120,580	81,400	225,400	36,500	56,750
{Revised}	84,300			142,700					
Cost effectiveness (US$/kg.)	5.01	7.83	7.83	5.18	7.83	7.83	3.88	0.84	7.83
National Coordinating Agency	Hazardous Substances Control Division (DIW)								
Implementing Agency	World Bank								UNDP
Technical review completed?	Yes								
Secretariat's Recommendations									
Amount recommended (US $)	84,300	88,500	177,750	142,700	120,580	81,400	225,400	36,500	56,750
Project Impact (ODP tonnes)	16.8	11.3	22.7	27.5	15.4	10.4	58.1	43.5	7.25
Cost effectiveness (US $/kg)	5.01	7.83	7.83	5.18	7.83	7.83	3.88	0.84	7.83
Implementing Agency support cost (US$)	10,959	11,505	23,108	18,551	15,675	10,582	29,302	4,745	7,377
Total cost to Multilateral Fund	95,259	100,005	200,858	161,251	136,255	91,982	254,702	41,245	64,127

PROJECT DESCRIPTION

Foam Sector Profile

Sector ODS consumption (1991) reported in country programme	1510 tonnes ODP
Most recent consumption data	not available
ODS to be phased out in approved projects (as at July 1997)	1245 tonnes ODP
ODS reported to have been phased out (as at July 1997)	300 tonnes ODP
ODS to be phased-out in current proposed projects	432 tonnes ODP
Latest (1995) CFC-11 consumption reported according to Art.7	3001 tonnes ODP

1. Siam Chaicharoen, Century Plastics and General Injection produce thermoware products; Can Asia, Treathaboon, Viriyakit produce insulated boxes (containers); and Trade produce sprayfoam while Nekkei Thai produces panels.

2. The baseline equipment of the companies are as follows:

Thermoware	
Siam Chaicharoen	1 Gusmer FF-1600 (1986)
	1 OMS C8 (1989) 7 kg/min (1:1 ratio), 8 kg/min variable ratio
Century Plastics	1 Gusmer H-II (1980)
General Injection	1 OMS FM8 (1993) 8 kg/min
Insulated Containers	
Can Asia	1 EMB high pressure dispenser (1994)
	1 EMB Puromat 80 low pressure dispenser destroyed by fire January 1997.
Treathaboon	No equipment. Chemicals hand-mixed and hand-poured into steel molds
Viriyakit	No equipment. Chemicals hand-mixed and hand-poured into rotating molds
Sprayfoam	
Thermabond	2 Gusmer FF-1600
PU Foam Insulation	5 Gusmer FF-1600 (1994 and early 1995)
	1 Gusmer H-2000 (1995)
Panels	
Nekkei Thai	2 high pressure dispensers MEG-Acma
	1 Gusmer FF-1600

3. All the companies will replace the use of CFC-11 with HCFC-141b as an interim solution with requests for retrofit of existing high pressure dispensers, replacement of low pressure dispensers with high pressure and installation of high pressure dispensers where there is no

baseline equipment. Additional information on these proposals are provided under each enterprise.

(a) CAN ASIA - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers)

1. The capital costs include installation of one high pressure foam dispenser output 60 kg/min in place of the manual operations at a cost of US $100,000 with US $30,000 company contribution and local works (US $20,000).Trials, technology transfer and training amount to US $15,000. Capital costs also include contingency (US $10,500). Incremental operating costs of US $23,500 are expected based on the use of the following chemicals: 18 tonnes CFC-11; 10.7 tonnes HCFC-141b and 40 tonnes premix charges.

2. Incremental operation costs were calculated using the following prices: CFC-11: US $2.10/kg; HCFC-141b: US $3.60/kg; premix charges: US $3.20/kg.

(b) SIAM CHAICHAROEN conversion to CFC-free technology in the manufacture of rigid polyurethane foam (thermoware)

1. The capital costs include the replacement of the low pressure dispenser by a high pressure unit of output 10 kg/min (US $90,000) and the retrofit of the existing Gusmer unit (US $5,000).Trials, technology transfer and training amount to US $15,000. Capital costs also include contingency (US $11,000). Incremental operating costs of US $21,000 are expected based on the use of the following chemicals: 12.5 tonnes CFC-11; 10.6 tonnes HCFC-141b.

(c) TREATHABOON - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers)

1. The capital costs include the replacement of the low pressure dispenser by a high pressure OMS unit (US $75,000) which is already installed and associated costs, namely the equipment was procured and installed following a fire which destroyed the foaming machine (EMB Puromat 80 (1992)), customs and freight (US $1,000), installation and training (US $11,000), and local works (US $4,000). These capital costs do not include contingency. In addition, cost of trials, technology transfer and training amounting to US $25,000 is being requested. Incremental operating costs of US $83,500 are expected based on the use of the following chemicals: 25 tonnes CFC-11; 21.25 tonnes HCFC-141b and 75 tonnes premix charges.

(d) VIRIYAKIT - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers)

1. The capital costs include installation of one high pressure foaming machine 60/30 kg/min in place of its manual operations at a cost of US $100,000 less US $30,000 as company

contribution. Trials, technology transfer and training amount to US $15,000. Capital costs include contingency costs of US $8,500. Incremental operating costs of US $71,200 are expected based on the use of the following chemicals: 30 tonnes CFC-11; 23 tonnes HCFC-141b and 66 tonnes premix charges.

(e) GENERAL INJECTION - conversion to CFC-free technology in rigid polyurethane foam (thermoware)

1. The capital costs include the replacement of the existing low pressure unit by one high pressure foaming machine of output 10kg/min (US $90,000). Trials, technology transfer and training amount to US $15,000. Capital costs include contingency costs of US $10,500. Incremental operating costs of US $28,500 are expected based on the use of the following chemicals: 17 tonnes CFC-11; 14.45 tonnes HCFC-141b.

(f) THERMOBOND - conversion to CFC-free technology in rigid sprayfoam applications

1. The capital costs include the retrofit of both existing units (US $10,000). Trials, technology transfer and training amount to US $15,000. Capital costs include contingency costs of US $2,500. Incremental operating costs of US $57,000 are expected based on the use of the following chemicals: 11.5 tonnes CFC-11; 9.8 tonnes HCFC-141b and 7 tonnes premix charges.

(g) PU FOAM INSULATION AND TRADE - conversion to CFC-free technology in rigid sprayfoam applications

1. The capital costs include the retrofit of the Gusmer FF 1600 existing units (US $25,000); the retrofit of the Gusmer H-2000 unit (US $10,000), and one premixer and premixing station (US $60,000). Trials, technology transfer and training amount to US $15,000. Capital costs include contingency costs of US $11,000. Incremental operating costs of US $104,400 are expected based on the use of the following chemicals: 64 tonnes CFC-11; 54 tonnes HCFC-141b

(h) NIKKEI THAI - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (panels)

1. Nikkei Thai will phaseout the use of CFC-11 in the manufacture of rigid polyurethane foam panels. The company has two high pressure dispensers MEG-Acma (1991) both with a capacity of 81 lit/min, and one spray machine Gusmer FF (1990).

2. The capital costs include the retrofit of the Gusmer FF existing units (US $5,000) and the retrofit of both high pressure dispensers (US $40,000). Trials, technology transfer and training amount to US $15,000. Capital costs include contingency costs of US $6,000.

Incremental operating costs of US $80,000 are expected based on the use of the following chemicals: 48 tonnes CFC-11; 40.8 tonnes HCFC-141b

(i) CENTURY PLASTICS - conversion to CFC-free technology in rigid polyurethane foam (thermoware)

1. Century Plastics will phaseout the use of CFC-11 in the manufacture of rigid polyurethane foam thermoware. The company has one Gusmer H-II (1980).

2. The capital costs include the reimbursement for Gusmer H-2000 (US $28,000), a pump replacement (US $5,000), and installation (US $5,000). Trials, technology transfer and training amount to US $15,000. Capital costs include no contingency costs. Incremental operating costs of US $13,500 are expected based on the use of the following chemicals: 8 tonnes CFC-11; 6.8 tonnes HCFC-141b.

Justification for the Use of HCFCs

3. The above enterprises have chosen interim use of HCFC-141b until a suitable final solution is available, since HCFC-141b offers the lowest investment costs.

Equipment or Components to be Destroyed or Rendered Unusable

4. For most of the above projects, the destruction methods of the replaced units are not indicated.

Impact of Project on 1999 Freeze

5. So far, the Executive Committee has approved 19 investment projects in Thailand to phase out 1,245 tonnes of CFC used in the foam sector; additional 66.5 tonnes of CFCs would be eliminated once all the five projects under consideration become operational, bringing the total CFC phased out to 1,311.5 tonnes (equivalent to 86.8 per cent of the CFC consumption in the sector).

6. The project proposals state that "the ODS consumptions for 1995 and 1996 are 8,779 and 6,041 ODP tonnes, respectively. It is estimated that ODS consumption in 1997 will be the average of 1995 and 1996 at 7,420 ODP tonnes. Therefore, the average annual consumption for the three years 1995, 1996, 1997 will be 7,420 ODP tonnes. Forecast consumption in 1999, based on unconstrained demand and 6% GDP annual growth rate using 1997 as the starting point, would lead to an estimated consumption of 8,337 ODP tonnes. In order to meet the obligations of the Montreal Protocol in 1999, Thailand must eliminate at least 917 ODP tonnes per annum. Approval of these project proposals would eliminate some 66.5 ODP tonnes and make a significant contribution to enable Thailand to meet its obligations under the Montreal Protocol commencing in 1999".

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

1. The projects were discussed between the Fund Secretariat and the Implementing Agency against the background of agreement reached on similar projects submitted to the 22nd Meeting. The costs agreed are as indicated in the cover. In the case of Can Asia the company contribution to the high pressure machine and local works was agreed as US $50,000. A similar amount was agreed as company contribution by Viriyakit. Century Plastic is eligible for part of the cost only to remain at the threshold alue of the subsector.

RECOMMENDATION(S)

1. The Fund Secretariat recommends blanket approval of the umbrella project with funding levels and associated support costs as indicated in the table below.

Project Title	Project Cost US $	Support Cost US $	Implementing Agency
(a) CAN ASIA - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers)	84,300	10,959	World Bank
(b) SIAM CHAICHAROEN conversion to CFC-free technology in the manufacture of rigid polyurethane foam (thermoware)	88,500	11,505	World Bank
(c) TREATHABOON - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers)	177,750	23,108	World Bank
(d) VIRIYAKIT - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (containers)	142,700	18,551	World Bank
(e) GENERAL INJECTION - conversion to CFC-free technology in rigid polyurethane foam (thermoware)	120,580	15,675	World Bank
(f) THERMOBOND - conversion to CFC-free technology in rigid sprayfoam applications	81,400	10,582	World Bank
(g) PU FOAM INSULATION AND TRADE - conversion to CFC-free technology in rigid sprayfoam applications	225,400	29,302	World Bank
(h) NIKKEI THAI - conversion to CFC-free technology in the manufacture of rigid polyurethane foam (panels)	36,500	4,745	World Bank
(i) CENTURY PLASTICS - conversion to CFC-free technology in rigid polyurethane foam (thermoware)	56,750	7,377	UNDP

PROJECT EVALUATION SHEET
THAILAND

SECTOR: FOAMS ODS use in sector (1991): 1,510 ODP tonnes

Sub-sector cost-effectiveness thresholds: Flexible Foam US $6.23/kg
Integral Skin US $16.86/kg

Project Titles:
(a) NOVOCHEM - conversion to CFC-free Technology in the Manufacture of Integral Skin Polyurethane Foam
(b) CHAREON PORN - conversion to CFC-free Technology in the Manufacture of Flexible Slabstock Polyurethane Foam
(c) NUN CHAROEN - Conversion to CFC-free technology in the manufacture of Flexible Polyurethane Boxfoam
(d) THAI INTERNATIONAL - conversion to CFC-free Technology in the Manufacture of Flexible Slabstock Polyurethane foam (Boxfoam)

Project Data	**Integral Skin**	**Flexible**		
	Novochem	**PORN**	**NUN**	**Thai Int'l**
ODS phase-out (ODP tonnes)	19.7	15	16.8	15
Proposed project duration (months)	24	24	24	24
Incremental capital cost (US $)	271,700	169,000	121,000	110,000
- including contingency (%)	10	10	10	10
Incremental operational cost (US $)	25,000	3,500	48,000	(16,500)
Total project cost (US $)	296,700	172,500	169,000	93,500
Local ownership (%)	100	100	100	100
Export component (%)				
Amount requested (US $) {Original}	296,700	93,500	105,000	93,500
{Revised}				
Cost effectiveness (US $/kg)	15.06	6.23	6.23	6.23
National Coordinating Agency	Hazardous Substances Control Division Department of Industrial Works (DIW)			
Implementing Agency	UNDP			
Technical review completed?	Yes	Yes	Yes	Yes

Secretariat's Recommendations:				
Amount recommended (US $)	Pending	Pending	105,000	Pending
Project impact (ODP tonnes)			16.8	
Cost effectiveness (US $/kg)			6.23	
Implementing Agency support cost (US $)			13,650	
Total cost to Multilateral Fund (US $)			118,650	

PROJECT DESCRIPTION

Foam Sector Profile

Sector ODS consumption (1991) reported in country programme	1510 tonnes ODP
Most recent consumption data	not available
ODS to be phased out in approved projects (as at July 1997)	1245 tonnes ODP
ODS to be phased-out in current proposed projects	432 tonnes ODP
Latest (1995) CFC-11 consumption reported according to Art. 7	3001 tonnes ODP

(a) Novochem - conversion to CFC-free technology in the manufacture of integral skin polyurethane foam

1. Novochem will phaseout the use of CFC-11 in the manufacture of integral skin polyurethane foam for gaskets for electrical board markets to water blown formulations with interim use of HCFC-141b. The company currently has no base equipment at its disposition.

2. The capital costs for the conversion include installation of one specialty mixing and metering system (US $202,000), one premixer (US $60,000), trials, technology transfer and training (US $25,000). Incremental operating costs of US $25,000 are expected based on the amount of chemicals used i.e. 21.5 tonnes CFC-11 and 16.5 tonnes HCFC-141b. Since the company is currently compounding without the use of equipment, a company contribution of US $40,000 is included to compensate for the baseline condition.

3. The following prices of chemicals (where applicable) were used to calculate the incremental operational costs of the projects: CFC-11: US $ 2.10/kg, HCFC-14b: US $3.60/kg; methylene chloride: US $ 1.00/kg; (US $ 2.00/kg in Thai International).

Justification for the Use of HCFC

4. The enterprise has decided to use HCFC-141b blowing agent on an interim basis until it has fully developed all water blown formulations for use.

(c) Nun Charoen - Conversion to CFC-free technology in the manufacture of flexible polyurethane boxfoam

1. Nun Charoen will convert from the use of CFC-11 in the manufacture of flexible polyurethane boxfoam to low index/additive (LIA) technology. The enterprise operates three boxfoams with flat top systems, and has a rebond installation with two vertical and one horizontal saw for fabrication.

2. The capital cost of conversion includes one semi-automatic boxfoam unit (US $95,000) to replace the existing three boxfoams, trials, technology transfer and training (US $15,000). Incremental operating costs of US $48,000 are to be expected based on the amount of chemicals used.

(b) Chareon Porn - conversion to CFC-free technology in the manufacture of flexible slabstock polyurethane foam

(d) Thai International - conversion to CFC-free technology in the manufacture of flexible slabstock polyurethane foam (boxfoam)

1. The two companies will convert from the use of CFC-11 in the manufacture of flexible foams for mattresses and furniture applications to methylene chloride technology.

2. Charoen Porn operates a low pressure Viking 375 (1994) machine, while Thai International operates a semi-automatic CEMCO (1980) machine.

3. The capital cost of conversion at Charoen Porn includes retrofit of the low pressure machines (US $115,000), trials, technology transfer and training (US $38,500). Incremental operating costs of US $3,500 are to be expected.

4. The capital cost of conversion at Thai International includes the retrofit of the boxfoam unit (US $50,000), ventilation system (US $35,000), trials, technology transfer and training (US $15,000). Incremental operating benefits of US $16,500 are to be expected based on the amount of chemicals used.

Equipment or Components to be Destroyed or Rendered Unusable

5. If applicable, the replaced equipment will be destroyed. However, no method of destruction is mentioned in the above projects.

6. Conversion to methylene chloride technology at Chareon Porn and Thai International will require retrofitting the existing foaming machine. Each proposal lists the brand name of equipment to be retrofitted, its capacity and year of purchase.

Impact of Project on 1999 Freeze

7. So far, the Executive Committee has approved 19 investment projects in Thailand to phase out 1,245 tonnes of CFC used in the foam sector; additional 66.5 tonnes of CFCs would be eliminated once all the five projects under consideration become operational, bringing the total CFC phased out to 1,311.5 tonnes (equivalent to 86.8 per cent of the CFC consumption in the sector).

8. The project proposals state that "the ODS consumptions for 1995 and 1996 are 8,779 and 6,041 ODP tonnes, respectively. It is estimated that ODS consumption in 1997 will be the average of 1995 and 1996 at 7,420 ODP tonnes. Therefore, the average annual consumption for the three years 1995, 1996, 1997 will be 7,420 ODP tonnes. Forecast consumption in 1999, based on unconstrained demand and 6% GDP annual growth rate using 1997 as the starting point, would lead to an estimated consumption of 8,337 ODP tonnes. In order to meet the obligations of the Montreal Protocol in 1999, Thailand must eliminate at least 917 ODP tonnes per annum. Approval of these project proposals would

eliminate some 66.5 ODP tonnes and make a significant contribution to enable Thailand to meet its obligations under the Montreal Protocol commencing in 1999".

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

Integral Skin Foam

(a) Novochem - conversion to CFC-free technology in the manufacture of integral skin polyurethane foam

1. Based on expert advice to the Secretariat the following cost items are still being discussed with the Implementing Agencies.

- change of molds following conversion
- provision of heating ovens
- replacement of low pressure with high pressure machines.

2. Agreed costs will be communicated to the Sub-Committee on Project Review.

(
Flexible Slabstock Foam

c) Nun Charoen - Conversion to CFC-free technology in the manufacture of flexible polyurethane boxfoam

1. The costs were agreed between the Fund Secretariat and the Implementing Agency.

(b) Chareon Porn - conversion to CFC-free technology in the manufacture of flexible slabstock polyurethane foam

(d) Thai International - conversion to CFC-free technology in the manufacture of flexible slabstock polyurethane foam (boxfoam)

1. The Fund Secretariat and UNDP discussed issues regarding the request for retrofitting existing foaming machines and related costs, storage tanks for methylene chloride where CFC storage tanks exist at the plants, the cost of the metering system requested for Chareon Porn, and the price of chemicals. The outcome of these discussions will be communicated to the Sub-Committe on Project Review.

RECOMMENDATION(S)

1. The Fund Secretariat recommends blanket approval of the Nun Chareon project with associated support costs at the funding level shown in the table below:

Project Title	Project Cost US $	Support Cost US $	Implementing Agency
(a) NOVOCHEM - conversion to CFC-free Technology in the Manufacture of Integral Skin Polyurethane Foam	Pending		UNDP
(b) CHAREON PORN - conversion to CFC-free Technology in the Manufacture of Flexible Slabstock Polyurethane Foam	Pending		UNDP
(c) NUN CHAROEN - Conversion to CFC-free technology in the manufacture of Flexible Polyurethane Boxfoam	105,000	13,650	UNDP
(d) THAI INTERNATIONAL - conversion to CFC-free Technology in the Manufacture of Flexible Slabstock Polyurethane foam (Boxfoam)	Pending		UNDP

PROJECT EVALUATION SHEET
THAILAND

SECTOR: REFRIGERATION ODS use in sector (199): 500 ODP tonnes

Sub-sector cost-effectiveness thresholds: Commercial US $15.21/kg
Domestic US $13.76/kg

Project Titles:

(a) Building chiller replacement programme to reduce the usage of CFC-11 and CFC-12 in chiller servicing at Electricity Generating Authority of Thailand (EGAT)
(b) Elimination of ODS used in the production of household refrigerators at Hitachi Consumer Products
(c) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation at Padriew Co. Ltd..
(d) Conversion of CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation at Sahakarn Intercool
(e) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation in the manufacture of water coolers at Siam Cooler
(f) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation in the manufacture of water coolers at Sirithana

Project Data	**Chiller**	**Domestic**	**Commercial**			
	EGAT	Hitachi	Padriew	Sahakarn	Siam Cooler	Sirithana
ODS phase-out (ODP tonnes)	59.9	149	10.24	5.7	26.38	8.06
Proposed project duration (months)	72	12	18	18	18	18
Incremental capital cost (US $)		1,487,020	82,492	81,706	82,945	80,175
- including contingency (%)		0	10	10	10	10
Incremental operational cost (US $)		1,215,000	108,640	70,101	531,074	148,076
Total project cost (US $)	4,950,000	2,702,020	191,132	151,807	614,019	228,251
Local ownership (%)	100	51	100	100	100	100
Export component (%)						
Amount requested (US $) {Original}	4,950,000	1,227,257	155,750	86,697	401,239	122,593
{Revised}						
Cost effectiveness (US $/kg)	n/a	8.24	15.21	15.21	15.21	15.21
National Coordinating Agency	Department of Industrial Works (DIW)					
Implementing Agency	World Bank					
Technical review completed?	Yes					

Secretariat's Recommendations:

Amount recommended (US $)						
Project impact (ODP tonnes)						
Cost effectiveness (US $/kg)						
Implementing Agency support cost (US $)						
Total cost to Multilateral Fund (US $)						

PROJECT DESCRIPTION

Chillers

(a) Building chiller replacement programme to reduce the usage of CFC-11 and CFC-12 in chiller servicing at Electricity Generating Authority of Thailand (EGAT)

1. The project proposes to pilot a financing scheme to replace the CFC-based chillers in Thailand with high energy efficient chillers using HFC-134a and HCFC-123 as refrigerants.

2. Currently there are about 1,500 CFC-based chillers which were installed before 1993 after which new CFC-based chillers were no longer available in Thailand. With about 500 kg. of CFC used in each chiller, the total consumption of CFC of these chillers is about 700 MT. With a running time of 365 days a year, the chillers have an average annual CFC leakage rate of around 10 percent of CFC, or 50 kg per chiller. Servicing these chillers will consume somewhere around 70 MT of virgin CFC every year. In addition to reducing CFC demand for servicing, the project will recover and recycle the CFC from the replaced chillers to be used for servicing the existing chillers, thus reducing the demand for virgin CFC. Most of these chillers have a remaining lifetime of 10-15 years.

3. The World Bank is requesting US $ 4.95 million from the Multilateral Fund to be used as start-up fund to purchase new CFC-free chillers to replace as many existing chillers as could be supported by the requested funding. The owners of the buildings where the chillers will be replaced will commit themselves to paying back the cost of the new chillers with the energy savings from the new chillers on monthly basis for 15 years.

4. The World Bank will use the Electricity Generating Authority of Thailand to manage the project for 3 years as a pilot scheme and undertake an evaluation at the end of the 3 years to determine the success of the effort. If the result is positive, external financing will be mobilized to replace all the existing chillers. If not, the remaining fund will be returned to the Fund.

Domestic refrigeration projects

(b) Elimination of ODS used in the production of household refrigerators at Hitachi Consumer Products

1. The sector description in the project document contains the following information: ODS consumption in the household refrigeration sector is estimated at 930 MT (1991). However, the production of household refrigerators and freezers in Thailand has increased significantly in recent years, from about 560,000 units in 1989 to approximately 2 million units in 1995. Presently, there are eight major manufacturers of household appliances. Thailand recently introduced a regulation banning the use of CFCs in new refrigerators.

2. Projects from four enterprises were approved by the Executive Committee on the basis of two phases: Phase I was to provide for engineering, assistance, training, and testing, and Phase II would allow for the elimination of CFC-11 and CFC-12 through installation of new equipment necessary for mass production of CFC-free appliances. These projects are phasing out 777 ODP tonnes.

3. Hitachi project is the last one in the domestic refrigeration sector. The remaining domestic refrigeration enterprises produce mainly for export. They are phasing out ODSs without assistance from the Multilateral Fund. According to the proposal submitted to the 10th Meeting, the plant had a total installed capacity of 250,000 units a year on one production line in 1993. Hitachi expected to reach its maximum capacity by 1994. The actual annual production level was 142,000 units. Currently, the production capacity of line 1 is 300, 000 units a year. A second production line was added in 1995, bringing the total production capacity to 500,000 units/year. The second line is not part of the project.

4. The Phase II proposal states that the enterprises undertook the following activities, which were endorsed by the World Bank, while implementing Phase I:

- Installation of new test rooms and acquisition systems and modification of existing ones.
- Purchase of quality control equipment
- Purchase of leak detectors, charging machines, vacuum pumps
- Technical assistance from parent companies
- Testing of refrigerators
- Other equipment for mass production

5. Thus, this enterprise has proposed the installation of equipment compatible with the use of HFC-134a as a replacement for CFC-12 and HCFC-141b as a transitional replacement for CFC-11 in the refrigerant and foam components of the conversion, respectively.

6. Phase II proposal requests additional funding to procure additional equipment including replacement of leak detectors, modification of test room, extension of vacuuming line and purchase of new vacuum pumps, replacement of dry air system, vacuum forming equipment for plastic liner, replacement of molds, jigs for foaming operations, technical assistance for production assembly and quality control, and to compensate for incremental operating costs for 6 months duration, including incremental cost of HFC-134a compressors. Conversion of Phase II is completed. Funds are requested retroactively.

7. The level of grant was determined as the sum of capital cost of Phase II and six months of cost, discounted by the percentage of foreign ownership and offset by the amount approved at the 10th meeting (Phase I).

8. The company has selected HCFC-141b as a blowing agent understanding that it is a transitional technology. In response to the Thai government's decision to ban the use of

CFC-11 in the production of household refrigerators starting from 1 January 1997 the company decided to use HCFC-141b as a transitional substance before switching to cyclopentane or other alternatives. The selection of this technology was recommended by the parent company in Japan which is currently using HCFC-141b as a blowing agent. HCFC-141b has a thermal conductivity comparable with CFC-11 resulting in similar insulation performance.

9. About 23% of Hitachi's production is exported (all to Article 5 countries).

10. Hitachi will dispose of 3 CFC-12 leak detectors and 3 vacuum foaming machines after the Phase II project receives approval by the Executive Committee.

Commercial Refrigeration Projects

(c) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation at Padriew Co. Ltd..

(d) Conversion of CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation at Saharan Intercool

(e) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation in the manufacture of water coolers at Siam Cooler

(f) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation in the manufacture of water coolers at Sirithana

1. ODS consumption in the commercial refrigeration sector is estimated at 1042 MT (1996). No sector annual growth rate is quoted. The Executive Committee approved two commercial refrigeration projects, phasing out 35 ODP tonnes.

2. The five projects are for enterprises that manufacture water cooler units, a wide range of refrigeration equipment, display cabinets, refrigerators and freezers. The implementation of these projects will result in the phasing out of 110.28 t ODP.

3. It is stated that the implementation of these projects will contribute to helping Thailand achieve the 1999 ODS consumption freeze.

4. The projects selected HCFC -141b technology to replace CFC-11 use. The cyclopentane option was rejected because it is uneconomical and impractical, given the scope and nature of their operations. The advantages for HCFC-141b use are listed: low flammability, the technology is widely used in many non-Articles countries, and extensive training is not necessary. The disadvantages of the other technologies include: special mixing equipment

requirements, higher thermal conductivity, poor solubility, expensive, explosive, and special safety and equipment requirements.

5. Another justification for HCFC-141b use mentioned in the project for Padriew Co. Ltd. is the unreliable electrical supply to the factory which is a safety concern for cyclopentane use.

6. The enterprises agree not to seek further funding from the Multilateral Fund to switch to ODP free technology, such as cyclopentane, in the future.

7. These projects will convert to R-134a from CFC-12 use for refrigeration.

8. The incremental operating costs are requested for the higher cost of chemical, compressor, and drier, for a duration of two years.

9. The replaced equipment will be scrapped.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

(a) Building chillers replacement to reduce the usage of CFC-11 and CFC-12 in chiller servicing at Electricity Generating Authority of Thailand (EGAT).

1. New chillers based on HFC-134a and HCFC-123 are highly energy efficient. The saving calculated on the basis of lower energy consumption resulting from the replacement of old chillers would provide pay back on investment in about 3 years, with a rate of return of about 33 per cent.

2. From the economics of the proposal, it is a very attractive concept to any investors both in terms of the high rate of return and short pay back period.

3. Under the current policy of the Multilateral Fund for the chiller subsector where 'the energy savings should be taken into consideration when calculating the incremental costs of replacement' (UNEP/OzL.Pro/ExCom/12/37, paras 159-160), the incremental cost to be paid to each building owner will be substantially reduced, depending on the policy on the eligible period of incremental operating cost/savings for this specific sub-sector. Using a 4-year period the project should realize net savings and would not therefore be eligible for funding.

4. On another account, funding a project with such good economics now may not be fair to those projects for which conversion still incurs real costs, especially small and medium-sized enterprises.

5. The World Bank has been provided with the mandate and resources to propose a lending mechanism for the Multilateral Fund for which this proposal would fit in perfectly.

(b) Elimination of ODS used in the production of household refrigeration at Hitachi Consumer Products

1. The chosen technologies are proven. The choice of an interim HCFC technology in foaming operations is justified.

2. Several budget items under capital cost are requested in the project proposal which have never been a part of approved conversion projects using HCFC-141b and HFC-134a technologies. Such items include modification of life test room, replacement of dry air system, replacement of foaming jigs due to increase in foam density, and new vacuum forming equipment for ABS plastic liner. The latter is costed at US $ 708,116. It should be noted that the Executive Committee approved at its 10th Meeting US $1 million for testing for this enterprise.

3. The requested incremental operating costs (IOC) are calculated on the basis of prices for material which are higher than those used in projects approved for Thailand. IOC include incremental cost of 48,000 units of compressors or 32 per cent of the total number used in the first six months of 1997 which have been purchased from Hitachi Compressor Thailand. In 1996, all the compressors used by Hitachi have been sourced from Kulthorn Kirby and Sanyo. These two compressor manufacturing companies received assistance from the Fund for conversion of their production facilities to HFC-134a technology. The production of new compressors by the companies exceeds the current demands of domestic refrigerators produced in Thailand. Additionally, funds at US $ 395,456 have been approved at the 22nd Meeting for Kulthorn Kirby and Sanyo to cover the incremental operating costs associated with new lubricant. Since ODS consumption and other incremental operating costs are calculated on the basis of 1996 production level, and in accordance with Decision 22/26, incremental operating costs for compressors cannot be recognized as eligible for funding.

4. The Secretariat and the World Bank are still discussing the eligibility of the requested cost items and the level of funding associated with eligible incremental costs. The Sub-Committee on the Project Review will be informed accordingly.

(c) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation at Padriew Co. Ltd..

(d) Conversion of CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation at Saharan Intercool

(e) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation in the manufacture of water coolers at Siam Cooler

(f) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation in the manufacture of water coolers at Sirithana

General comments

1. Incremental operating costs for compressors are claimed in four projects for individual commercial refrigeration companies. Most of the compressors used by the above mentioned enterprises are sourced from Kulthorn Kirby compressor manufacturing company which has received financial assistance from the Multilateral Fund. The refrigeration equipment produced by the enterprises covered by the submitted proposals is relatively small units equipped with hermetic compressors, i. e. water cooler units, display cabinets and refrigerators/freezers with a charge not exceeding 1 kg of refrigerant. It was indicated in the project description for conversion of Kulthorn Kirby compressor company that nine models of its hermetic compressors are suitable for water coolers, freezers and domestic refrigerators. The Secretariat was informed that Kulthorn Kirby is also manufacturing compressors of larger size designed for specific applications

in production of commercial refrigeration equipment and conversion of this portion of Kulthorn Kirby production was not funded by the Multilateral Fund.

2. Guidelines approved by the Executive Committee in Decision 22/26 will independently apply to domestic and commercial refrigeration sub-sectors. Information on 1995 production of commercial refrigeration compressors and downstream user products has not been provided in the above mentioned projects as required by Decision 22/26. Although the Secretariat and the Implementing agencies identified some criteria, further work has to be done to accurately define domestic and commercial refrigeration.

3. Incremental operating costs associated with compressors need to be analyzed in light of information to be provided by the Government of Thailand in accordance with Decision 22/26.

4. Manual technique and simple equipment are used in refrigerant charging operation in most of companies. Only one company has a refrigerant charging machine (Sahakarn). A new machine is requested in each project. Two companies currently have hand mixing and pouring technology in their foam operations (Sirithana and Sahakarn). Two high pressure machines are requested at US $ 40,000 each. The issue of technological upgrade in projects with inadequate company's baseline is addressed in the document UNEP/OzL.Pro/ExCom/23/53 prepared by the Secretariat.

5. High cost for a filter dryer was requested as part of incremental operating cost in the submitted projects. This cost is not consistent with the cost approved for this item in Thailand other similar projects from Thailand.

General conclusion

1. The Secretariat and the World Bank are still discussing the eligibility and the level of funding of incremental costs in the above mentioned projects. The Sub-Committee on the Project Review will be informed accordingly.

RECOMMENDATION(S)

(a) Building chiller replacement programme to reduce the usage of CFC-11 and CFC-12 in chiller servicing at Electricity Generating Authority of Thailand (EGAT)

1. The Secretariat recommends that consideration of this proposal be deferred till the lending mechanism is proposed by the World Bank.

(b) Elimination of ODS used in the production of household refrigerators at Hitachi Consumer Products

(c) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation at Padriew Co. Ltd..

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(f) Conversion to CFC-12 commercial refrigeration to HFC-134a and CFC-11 to HCFC-141b as the blowing agent for foam insulation in the manufacture of water coolers at Sirithana

1. The Secretariat recommends that incremental operating costs associated with compressors should be separated out and resubmitted at the time when the necessary information is submitted by the Government of Thailand as per Decision 22/26.

2. The results of the ongoing discussions with the World Bank on the above five projects will be reported to the Sub-Committee on Project Review.