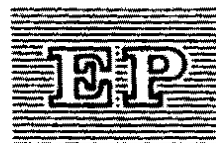




United Nations Environment Programme



Distr.
LIMITED



UNEP/OzL.Pro/ExCom/12/29
25 February 1994

ORIGINAL: ENGLISH

Executive Committee of
the Multilateral Fund for the
Implementation of the Montreal Protocol

Twelfth Meeting
Montreal, 28-30 March 1994

PROJECT PROPOSAL: THAILAND

This document includes the following project proposal and the Fund Secretariat's Comments and Recommendation:

1. Elimination of the use of CFCs in the manufacture of laminated rigid polyurethane foam insulation panels.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Thailand
PROJECT TITLE:	Elimination of the use of CFCs in the manufacture of laminated rigid polyurethane foam insulation panels (Modular Compound Co. Ltd.)
BUDGET:	US \$405,000 Incremental Capital Cost US \$103,000 Incremental Recurrent Cost
INCREMENTAL COSTS:	US \$508,000
ODS PHASE-OUT:	30 Tonnes CFC-11/year
COST EFFECTIVENESS:	US \$16.9 per Kg. ODP saved
PROJECT DURATION:	One year
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY :	Ministry of Environment, Department of Industrial Works (DIW)
TECHNICAL REVIEW COMPLETED:	YES <u> X </u> NO <u> </u>

SECRETARIAT'S COMMENTS

1. Modular Compound Co. Ltd. produces laminated rigid polyurethane foam panels. The Company will eliminate the use of 30 tonnes of CFC-11 by introducing water/HCFC-141b technology.
2. Water/HCFC-141b technology was chosen for the Modular Compound Company as an intermediate step. However, the choice of high pressure equipment will facilitate the step to a truly ODS-free system without additional capital costs as they mature.
3. The cost of the substitute, HCFC-141b is higher than CFC-11 and the cost of additional MDI is needed. Therefore, the total budget for the project is adjusted as a result of incremental recurrent costs in the amount of US \$103,000.
4. The project has been reviewed and is supported by a member of UNDP's Technical Review Panel.

SECRETARIAT'S RECOMMENDATION

1. The Secretariat recommends final approval in the amount requested, i.e., US \$508,000.

PROJECT COVER SHEET

COUNTRY: Thailand

PROJECT TITLE: MODULAR COMPOUND Elimination of the use of CFCs in the manufacture of laminated rigid polyurethane foam insulation panels

SECTOR COVERED: Foamed Plastics

ODS USE IN SECTOR: 1510t CFCs (=ODP) in 1991

PROJECT IMPACT: 30 TONS CFC-11/y

PROJECT DURATION: One year

PROJECT ECONOMIC LIFE: 10 Years

TOTAL PROJECT COSTS: USD 405,000 Incremental Capital Cost
USD 103,000 Incremental Recurrent Cost

PROPOSED MLF GRANT: USD 508,000

COST EFFECTIVENESS: USD 2.72/kg/y (unit abatement cost)

NATIONAL COORDINATING BODY: Ministry of Environment, Department of Industrial Works (DIW)

IMPLEMENTING AGENCY: UNDP

APPRAISAL DATE: December 10, 1993/February 9, 1994

PROJECT SUMMARY

Under this project Modular Compound Co. Ltd. ("Modular") will (i) eliminate the use of CFCs in the manufacture of laminated rigid PUF panels by the introducing water/HCFC-141b technology, and (ii) eliminate the use of CFCs in the production of PUF imitation wood by introducing all water blown foams. Incremental recurrent costs are partially offset by savings from the elimination of cleaning solvents and less material losses.

TECHNICAL ASSESSMENT

The project has been reviewed (Annex-A) and is supported by Jerry S. Pool, member of UNDP's Technical Review Panel.

PROJECT OF THE GOVERNMENT OF THE THAILAND
MODULAR COMPOUND ELIMINATION OF THE USE OF CFCs
IN THE MANUFACTURE OF
LAMINATED RIGID PUF PANELS AND IMITATION WOOD

1. PROJECT OBJECTIVE

The objective of this project is (i) to phase out the use of CFCs in the manufacture of laminated rigid PUF panels and imitation wood at Modular Compound and (ii) to institute a demonstration project for non/low ODS technology in rigid PUF for different applications in Thailand.

2. SECTOR BACKGROUND

ODS are used as blowing agents in the production of five types of foams in Thailand--appliance insulation, flexible foams, rigid insulating foams used in construction, polystyrene packaging and miscellaneous foams. With the exception of polystyrene and polyethylene foams, CFC-11 is used to some extent in the production of all these foam types. producers of foam products in Thailand used about 1,500t of ODS in 1991, Primarily CFC-11 and CFC-12.

The flexible foam (polyurethane foam) sub-sector has already substantial phased out the use of CFCs by replacing it with methylene chloride.

In other sub-categories CFC is, as before, the blowing agent of choice and replacement efforts were so far restricted to investigations, trials and project preparations.

3. ENTERPRISE BACKGROUND

Modular Compound was founded in 1982 as a privately owned 100% Thai company. Employing currently about 100, the company concentrates on the production of panels for cold storage and small trucks. Recently an imitation wood line was added to the manufacturing program. The business is a fast expanding one, due to the general economic climate in Thailand as well as to the booming tourist industry and related expansion in the sophisticated food industry which relies heavily on cold storage.

Modular Compound operates currently two low pressure foam dispensing units for the production of panels and one high pressure fixed ratio for the production of imitation wood.

4. PROJECT DESCRIPTION

Modular Compound utilized in 1993 about 30t CFC-11 in the manufacture of rigid PUF in laminated insulation panels. This is expected to increase to 50t in 1995, mainly based on recent expansion of the product line. The company intends to replace this ODS as soon as possible. Calculations in their document are based on 1994 estimated usage of 40t. For panels, a combination of reduced ABA (auxiliary blowing agent) technology and HCFC-141b is considered as the interim replacement of choice, followed by a non ODP technology that is not yet selected. Existing low pressure foam dispensing equipment has to be replaced with high pressure and a pre-blending unit will have to be installed. Some additional cost for trials will occur. In addition to equipment changes, recurrent incremental operating cost are expected, related to higher isocyanate use and the use of HCFC-141b.

For imitation wood immediate permanent replacement by water based formulations is foreseen. This will require variable ratio pumps on the (high pressure) foam dispensing unit. Again, higher material costs result from this change.

5. TECHNOLOGY

5.1 OVERVIEW

There are several options to replace CFCs in the production of rigid polyurethane insulation foam, such as:

- o CFC-11 > partial water/HCFC-141b > ?
- o CFC-11 > partial water/HCFC-22 > HFC-134a, 152a
- o CFC-11 > (cyclo-)pentane

In addition, compounds such as methylene chloride, HCFC 123, and water blown technologies have been suggested, but are either immature in technology, limited in availability or restricted applicability.

The first solution--also called the "liquid" solution--employs technology that is closely related to the existing CFC technology. The final step in this process is not yet decided. One potential solution is HFC-356, but full water blown foam with improved skin formation remains an option, specifically in "lesser demanding" systems.

The second one--also called the "gas" solution--utilizes a gaseous mixture of physical blowing agents, requires high pressure

equipment, and extensive process adjustments. The final step in this process is seen as the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use to encapsulated systems.

Pentane technology is lately commercially introduced on several occasions, but its flammable character requires safety conditions and limits its use. In addition, cyclopentane is regionally restricted in availability.

5.2 SELECTION

For cold storage panels, a combination of water-blown technology and the use of HCFC-141b is identified by the company as an alternative that is:

- o Proven technology in processing and product performance,
- o Environmentally acceptable,
- o Available in the Thai market,

The use of HCFC-22 would also be feasible, but has to be evaluated on its retention in the foam.

The choice of high pressure equipment will facilitate the step to a truly ODP-free system without additional capital costs.

For PUF imitation wood--where no insulation requirements have to be met--full direct replacement by a water blown system is feasible.

5.3 IMPACT ON PRODUCTION PROCESS

The use of reduced CFC technology will be facilitated through--but is not essentially depending on--the employment of high pressure foam dispensing equipment.

HCFC-141b is moderately flammable. For the intended purpose, the blends should not cause any risk, but a monitoring check at commissioning will be performed to assure safe working levels. The current mixing method should be replaced by an automated, pressurized one. This will save up to 20% ABA.

The increased use of water will change the polyol/isocyanate ratio. Variable ratio dispensing equipment is essential for the new technology.

6. PROJECT COSTS

6.1 CAPITAL COSTS

The following is a summary of the expected costs (in USD) of investment and related activities:

DESCRIPTION	AMOUNT (USD)
FOAM EQUIPMENT.....	270,000
1 medium output dispenser....	85,000
1 high output dispenser....	110,000
1 low output dispenser.....	75,000
TRIALS, START-UP.....	10,000
PRE-MIX STATION.....	65,000
FREIGHT, INSTALLATION.....	20,000
CONTINGENCY, ROUNDING.....	40,000
TOTAL.....	405,000

[Prices obtained from Impianti OMS, Italy]

6.2 OPERATING COSTS

Before: 30t CFC-11 @ 2,100.....	USD 63,000
After: 30t additional MDI @ 2,500.....	USD 75,000
9t HCFC-141b @ 4,000.....	USD 36,000
INCREMENTAL MATERIAL COSTS.....	USD 48,000
Savings on ABA.....	USD 13,000
Savings on cleaning agent.....	USD 5,500

RECURRENT INCREMENTAL COSTS.....USD 29,500

c	Net Present Value (4y; 10 % discount) ..USD	103,000
----------	--	----------------

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 405,000
b)	Annual Incremental Costs	USD 29,500
c)	Project Useful life	10 Years
d)	ODS Reduction/Year (base 1994)	kg 40,000
f)	Capital Recovery factor (10% discount)	0.16275

Unit Abatement Costs [{a(f) + b}/d] USD/kg/y 2.72

=====

7. FINANCING PLAN

The company requests the reimbursement of the complete project costs estimated on

USD 508,000

=====

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project and provide technical assistance.

8.2 PROCUREMENT

UNDP will oversee the procurement and provide technical assistance.

8.3 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after monitoring has confirmed that at no place on the

machine or in the working area unsafe levels of HCFCs can be detected.

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Pre Audit	x					
Order Confirmation(s)		x				
2. Installation						
Arrival, Customs			x			
Installation			x			
3. Start-up, Training						
Machine Start-up				x		
Trials/Training				x		
Post Audit/Commissioning				x		

9. PROJECT IMPACT

This project will eliminate the use of at least 20 tons of CFCs in the first year of implementation and ensure safety in plants that have already transferred to non-ODS technology on their own. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

- Annex A: Technical Assessment
- Annex B: Detailed equipment costs

MODULAR.PRO
94-02-10/01

RESOURCE POOL

Consulting In: Environmental and
OSHA Compliance.
Urethanes Process and
Machinery Technology.

Jerry S. Pool, President

3609 Huntingridge Drive
High Point, NC 27263
phone: 910-869-5712
fax: 910-869-5712

MODULAR COMPOUND CO., LTD.

SCOPE

The project is concerned with the replacement of CFC-11 in the manufacturing of rigid polyurethane foam.

RECOMMENDATION: The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

The document provides adequate information, with the exception of the calculation of operating costs. From the information given, it is difficult to determine the quantities of CFC-11 eliminated from the simulated wood or the rigid panels and therefore the amount of MDI needed.

12 tons 141b = 15 tons CFC-11, therefore
40 tons - 15 = 25 tons balance CFC-11 x 1.6 MDI demand =
40 tons of MDI and since the 141b is to replace 50% of the
CFC-11, 15 tons came from the panels and 10 tons from the
simulated wood foams.

TECHNICAL SOUNDNESS

The HCFC-141b is a good interium choice on the way to fully water blown foam for the rigid panels, however, K-factor for cold storage will not be as good as cyclopentane blown. As long as energy requirments are not critical, the choice is supported.

LESSON FROM EXPERIENCE

The simulated wood parts may require mold coating for surfaces.

ENVIRONMENTAL ISSUES

HCFC-141b has a residual ODP and will eventually be phased out.

SAFETY ISSUES

There are no particular safety issues to be addressed.

COST EFFECTIVENESS

The cost is typical of fairly low ODP elimination projects.

Jerry Pool
10/Feb/94

