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

Thirteenth Meeting
Montreal, 25-27 July 1994

PROJECT PROPOSALS: MALAYSIA

This document includes the following project proposals and the Fund Secretariat's Comments and Recommendations:

UNDP

- Elimination of CFC-11 and CFC-12 in the manufacture of refrigerators at Oyl Appliances.

World Bank

- Substitution of CFC-12 and CFC-11 with HFC-134a and HCFC-141b respectively and elimination of the use of 1,1,1, TCA in household refrigerator manufacturing at Matsushita Electric Co. Bhd.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Malaysia
PROJECT TITLE:	Elimination of CFC-11 and CFC-12 in the Manufacture of Refrigerators at Oyl Appliances
PROJECT COST:	Incremental capital cost US $835,000 Incremental operational cost US $105,000[1]
INCREMENTAL COST:	US $658,000[2]
ODS PHASE-OUT:	18 tons of CFC-11 in 1993 4 tons of CFC-12 (Total ODP = 22 tons)
COST EFFECTIVENESS:	US $42.7 per kg ODP saved
PROJECT DURATION:	Two years
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY:	Department of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. Under this project, Oyl Appliances will eliminate 22 tons of CFCs in the manufacture of household refrigerators and freezers, through application of cyclopentane technology for insulation foams and HFC-134a technology for the refrigerant cycle.

2. The requested capital costs cover the replacement and modification of existing equipment. Process development engineering and model redesign will be assisted by external qualified experts and backed up by testing at commercial laboratory.

3. Cyclopentane is a highly flammable material. Project covers safety measures, training of personnel and technology transfer costs.

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[1] Calculated for two years of operation.

[2] The incremental costs differ from the budget by accounting for 30 per cent transnational ownership (Singapore)

4. Incremental operational costs are borne by the higher costs of the compressor, refrigerant, drier, capillary and foam formulation. Incremental operational costs are calculated for two years current prices.

5. The Secretariat submitted a policy paper on the impact on the Fund of various operational cost durations in the domestic refrigeration sector. The operational cost durations will be an issue of discussion at the present meeting of the Executive Committee.

6. The incremental operational costs will be incurred only after the full production of a new product has started, i.e., two years from the time funds are received. The incremental operational costs are likely to decrease within the coming two years.

SECRETARIAT'S RECOMMENDATION

7. The Secretariat recommends final approval of the project and approval of the capital cost corresponding to the national ownership share of US $584,500.

8. The approval of incremental operational cost at US $73,500 is contingent on a decision from the Executive Committee regarding duration of the operational cost.

9. It is further recommended to request UNDP to reassess the incremental operational costs on the basis of market prices prevailing at the time when actual costs are incurred and to report back to the Executive Committee. Agency overhead costs should be adjusted accordingly.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Malaysia
PROJECT TITLE:	Substitution of CFC-12 and CFC-11 with HFC-134a and HCFC-141b respectively and elimination of the use of 1,1,1 TCE in household refrigerator manufacturing at MELCOM
BUDGET:	US $1,585,791.45 Capital Costs
INCREMENTAL COSTS:	US $902,315.331[1]
ODS PHASE-OUT:	The implementation of project will lead to elimination of 109.9 MT of ODS
COST EFFECTIVENESS:	Cannot be meaningfully calculated
PROJECT DURATION:	Three years
IMPLEMENTING AGENCY:	World Bank
NATIONAL COORDINATING AGENCY :	Department of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. This project covers Phase I of the conversion of the Matsushita Electric refrigerator manufacturing company (MELCOM) to HFC-134a as refrigerant and HCFC-141b as blowing agent. Phase I will address engineering development, prototyping, testing of new refrigerator models and testing of the new manufacturing technology. Costs associated with Phase I only are included in the project document.

2. Implementation of Phase I is already underway. Costs for certain components have already been incurred and funding is requested retroactively.

3. Phase II will address incremental costs associated with the mass production which will start in 1995. The request for funding will be submitted at a later stage.

[1] The incremental costs differ from the budget by accounting for 43.1 per cent transnational ownership.

4. The technology selected by Melcom is not an ultimate solution. The company is going to develop non-CFC refrigerators with the associated costs to be dealt within Phase II of the project.

5. The project was submitted by the World Bank on behalf of the Government of Malaysia for between-meeting approval on 12 April 1994. The Secretariat communicated its comments on the project to the World Bank on 20 April 1994. The World Bank has transmitted the comments to the Government of Malaysia. The Secretariat has not received any response on its comments as at 29 June 1994. The World Bank requested the Secretariat to submit the project for consideration to the Thirteenth Meeting of the Executive Committee.

6. The Secretariat raised several issues relating to the very high incremental costs of testing and to the incrementality of certain components of the project. The technical reviewers have also raised several issues on the same subjects.

SECRETARIAT'S RECOMMENDATION

7. The Fund Secretariat recommends granting permission to proceed to the World Bank regarding the Melcom Project with the view that incremental costs of the project should be revised taking into account Fund Secretariat's and technical reviewer's comments and the project should be resubmitted to the next meeting of the Executive Committee.

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	OYL APPLIANCES elimination of CFC-11 and CFC-12 in the manufacture of refrigerators
SECTORS COVERED:	Foam and refrigeration
ODS USE IN SECTOR:	600 MT in 1991 - foam 1,500 MT in 1991 - refrigerant
PROJECT IMPACT:	Phaseout of 18 MT of CFC-11 and 4 tons of CFC-12
PROJECT DURATION:	Two years
TOTAL PROJECT COST:	USD 835,000 Incremental Capital Cost USD 105,000 Incremental Recurrent Cost
PROPOSED MLF GRANT:	USD 658,000 (Reflecting 70 % local share)
COST EFFECTIVENESS:	USD 9.07 kg/yr (unit abatement cost)
NATIONAL COORDINATING AGENCY:	Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	7 June 1994

PROJECT SUMMARY

O.Y.L. Appliances is a 70% Malaysian-owned company belonging to the Hong Leong Group in Malaysia. It manufactures household and commercial refrigerators, freezers and air-conditioners, 90% of which are supplied to the domestic market. OYL currently uses CFC-11 as a blowing agent in the production of rigid foam panels, doors, lids and cabinets, and CFC-12 as a refrigerant in the cooling system. This project will eliminate the use of CFC-11 and CFC-12 by converting to cyclopentane technology and HFC-134a respectively. This project covers the redesign of all refrigerator models and production conversion.

Prepared by: Mr. T. Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sr. Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF MALAYSIA

O.Y.L. APPLIANCES - ELIMINATION OF CFC-11 AND CFC-12 IN THE MANUFACTURE OF REFRIGERATORS

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCS in the manufacture of household and commercial refrigerators, freezers at O.Y.L. Appliances Sdn. Bhd.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached 600 MT in 1991. CFC-11 (polyurethane foams) and CFC-12 (polystyrene and polyethylene foam sheet) are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115. The refrigerant is the biggest CFC-consuming sector which constitutes 1,500 MT in 1991. CFC-12 is the main substance used primarily in automobile and home appliance industries.

3. ENTERPRISE BACKGROUND

O.Y.L. Appliances Sdn. Bhd. is a 70% Malaysian-owned and 30% Singapore-owned private enterprise with a stated annual turnover of US$ 9.32 million in 1993. Of this figure, US$ 8.36 million pertained to the refrigeration activity. O.Y.L. produces household refrigerators, chest freezers, air-conditioners and commercial fridges. Presently, it carries 7 models of refrigerators and 5 models of freezers. Total units produced in 1992 and 1993 were 26,200 and 14,370 respectively, with the 1994 production figure estimated at 20,000 units. About 10% of its sales are exported. O.Y.L has a staff of over 200 employees, about 190 of which are concerned with refrigeration activities.

4. PROJECT DESCRIPTION

O.Y.L. utilized in 1993 about 18 MT of CFC-11 as a blowing agent in the production of rigid foam and 4 MT OF CFC-12 as refrigerant for the manufacture of home refrigerators and freezers. Cyclo-pentane and HFC-134a have been chosen as the respective CFC replacement. For the rigid foam line, the existing high-pressure machine with two mixing heads - one for cabinets and one for doors and lids - will be replaced with a new foam dispensing unit equipped with two different outputs and capable of handling pentane. A storage system for cyclopentane will be required. A pre-mixing station is required as cyclopentane cannot be obtained

premixed. Because of the flammability of cyclopentane, improved exhaust, ventilation and fire protection measures, including gas detectors, will have to be installed in compliance to local safety requirements. At the cabinet foaming plant, the electrical installation has to be changed in accordance with local requirements. Extensive safety training for plant personnel is foreseen.

The current refrigerant system will be changed to HFC-134a, and a new charging and vacuum system has to be installed for this purpose. A leak detector for HFC-134a will be required. Testing of cooling performance of each model will be done at outside testing facilities.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

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

i) HCFC-141b
ii) HCFC-142b
iii) HCFC-142b & HCFC-22
iv) HFC-134a
v) Cyclopentane (CP)

The company has decided to choose Cyclo-pentane because it has no ODP and constitutes a "permanent solution" in the manufacture of domestic refrigerators. CP is liquid up to 48C°. The use of pentane is increasingly applied and accepted in domestic and commercial refrigerators. However, its flammable characteristics require stringent safety measures.

HFC-134a has been the standard replacement for CFC-12 in the refrigerant industry so far. There is no other option commercially available.

5.2 PRODUCTION PROCESS

The use of cyclopentane and HFC-134a will require substantial changes in the production process and storage facilities. Those include:

Storage system

. Separate, explosion proof storage of the cyclopentane; pre-mixing station.

Equipment

. high pressure foaming machine, adapted for the use of flammable liquids.
. new charging and vacuum systems.
. new gas and leak detectors

Production

. separated production area for the foam process.
. modification of foaming mould.
. explosion proof motors, switches and other electrical systems.

Auxiliary safety devices

. upgraded ventilation system.
. fire protection system in foaming area.
. extra fire extinguishers.

Training

. reliability tests.
. fire safety training.
. production training.
. training on handling of new equipment.

Production area

. will be separated from other working areas for protection against fire hazards.

Production and maintenance personnel

. will be trained in the safe handling of hydrocarbons, in addition to production training. Start-up trials will be made to adjust for the different blowing agent.

6. PROJECT COSTS

6.1 TOTAL CAPITAL COSTS

The following is a summary of the expected costs of investment and related activities:-

DESCRIPTION	TOTAL (US$)
Foaming Equipment	
1 foaming machine	160,000
1 extra mixing head	40,000
1 pre-mixing unit	80,000
freight & installation	20,000
Storage System	
pentane drums system	25,000
installation and piping	15,000
Fire Safety System	
exhaust/ventilation	45,000
gas detector system	30,000
fire protection and extinguishers	15,000
explosion proof motors and switches	40,000
sealing of electrical control cabinets	10,000
Static discharge dissipation	10,000
Plant modification	30,000
Training	
start-up/training	10,000
safety training	10,000
trials	10,000
Sub-total:	550,000
Refrigerant equipment	
charging and vacuum equipment	85,000
leak detector for R-134A	5,000
Process development, engineering and model redesign	50,000
Training	10,000
Sub-total:	150,000
Outside testing (commercial lab.)	10,000
Pre/post audit	20,000
Technology transfer	30,000
Contingency & Rounding	75,000
TOTAL:	**835,000**

6.2 OPERATING COSTS

The estimation is based on a yearly production volume of 15,000 units of the 12 models to be redesigned. The cost of cyclo-pentane as a blowing agent is lower as compared to CFC-11. However, this will be offset by a higher insurance cost, maintenance and frequent training on safety and production.

On the refrigerant side, there is an extra cost per unit for separate compressor, etc. calculated to **US$ 4.25.** The annual extra costs = 15,000 x US$ 4.25 = **US$ 63,750.**

The incremental operating costs for two years, discounted at 10%, are expected to be **US$ 105,000.**

6.3 UNIT ABATEMENT COST

a)	ODS reduction project cost	US$ 835,000
b)	Annual incremental cost	63,750
c)	Project useful life	10 years
d)	ODS reduction/year	22,000kg
f)	Capital recovery factor (10%)	0.16275
Unit abatement cost [(a(f + b)/d]		US$/kg/yr 9.07

7. FINANCING PLAN

The company requests the reimbursement of 70% of the total project cost, reflecting the local equity, estimated at:

US$ 658,000

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 that no place on the machine or in the working area unsafe levels of pentane can be detected and all product requirements are met.

TASK	TIME FOR COMPLETION (MONTHS)
	1 2 3 4 5 6 7 8 9 10 11 12 13 to 23 24
Preparation	
MLF Approval	x
Procurement Prep.	x
Vendor selection	x
Installation	
Arrival, Customs	x
Installation	xxx
Start-up,	
Machine Start-up	xxx
Trials, Training	xxxxxxxxxxxxxxxxx
Certification	x

9. PROJECT IMPACT

This project will eliminate the use of at least 22 MT of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

Annex: Technical Assessment

MALOYL.DOC
94-06-07/04

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1.	COUNTRY OF ORIGIN:	MALAYSIA
2.	PROJECT TITLE:	OYL APPLIANCES elimination of CFC-11 and CFC-12 in the manufacture of refrigerators
3.	(SUB)SECTOR	Foamed and refrigeration
4.	CP RELATIONSHIP:	Not known
5.	TECHNOLOGY:	The choice of technology of the company is cyclopentane. This is supported. Although cyclopentane requires more investment than, for instance, HCFC-141b, it is a non-ODP technology and has therefore permanent character under the MLF. The operating cost are competitive with CFC-11 technology. HFC-134a as replacement for CFC-12 is also supported. It is by far the most commonly applied replacement technology. The original replacement cost were very high with a minimum of explanation. We have therefore suggested to use cost figures prepared by Unimagna/Philippines, that look more reasonable. If anything, the cost in domestic refrigeration (OYL) should be lower and not higher than for commercial refrigeration (Unimagna)

6.	ENVIRONMENTAL IMPACT:	Cyclopentane is highly flammable and needs to be processed with suitable precautions. The project addresses this issue adequately. It is also photochemically active (a "smog" generator) and the recipient should monitor carefully the development of potential local regulation. HFC-134a has a significant global warming potential, but is from the view of its environmental impact superior to CFC-12
7.	PROJECT COSTS:	The unit abatement cost are higher (19.55 vs 16. 32) than for a similar project in Malaysia, based on the size of production
8.	IMPLEMENTATION:	Adequate
9.	RECOMMENDATION:	The project is recommended for approval with the reduced costs for the retrofit of the refrigeration circuit

PROJECT COVER SHEET
(PROJECT 1)

2nd Revision
15-2-1994

COUNTRY	MALAYSIA
PROJECT TITLE	Substitution of CFC-12 and CFC-11 with HFC-134a and HCFC-141b respectively and elimination the use of 1,1,1 TCE in Household refrigerator manufacturing
SECTOR COVERED	Household Refrigerator
ODS CONSUMPTION (IN 1992 FISCAL YEAR)	18.0 Tonnes of CFC-12 (Refrigerant) 80.6 Tonnes of CFC-11 (Blowing Agent) 11.3 Tonnes of 1,1,1 TCE (Cleaning Solvent)
PROJECT IMPACT	Elimination of the use of 109.9 Tonnes of Ozone Depleting Substances (ODS) annually.
PROJECT DURATION	3 Years
PROJECT ECONOMIC LIFE	10 Years
TOTAL PROJECT COST	US$ 1,585,791.45
PROPOSED FOR FINANCING	US$ 902,315.33 (based on 56.9% of local public listed share, which exclude the ownership of transnational corporation, Matsushita Electric Industrial Co. Ltd., Japan 43.1%)
IMPLEMENTING ENTERPRISE	MATSUSHITA ELECTRIC CO.,(M) BHD.- BANGI PLANT (Hereinafter called MELCOM)
PLANT LOCATION	Lot No.7, Jalan P/2A, Bandar Baru Bangi, Bangi Industrial Site, 43650 Kajang, Selangor Darul Ehsan.
NATIONAL COORDINATING AGENCY	Department of Environment
IMPLEMENTING AGENCY	World Bank

PROJECT SUMMARY

The duration of the project is 3 years (1993 to 1995). With the successful completion of the project Melcom will be able to substitute the use of ODS in the manufacturing of refrigerators. The substitution will be made of the CFC12 to HFC134a, blowing agent CFC 11 to HFC 141b, and solvent 1.1.1 TCE to water soluble oil.

In doing so major changes must be carried out on the materials, components and processing methods. Melcom is callobrating with Matsushita Electric Industrial Japan (Hereinafter called MEI) to produce the ODS free refrigerators. MEI will be responsible for the materials and components research whilst Melcom is responsible to verify these results and develop a total product, including manufacturing changes.

Melcom currently produces 13 (thirteen) refrigerator models on a single assembly line. The company has made a decision to begin its conversion to CFC-free models by initially converting 7 (seven) models by the end of 1995; the remaining 6 (six) models will be converted later. Melcom believes that the imminent production phaseout of CFCs requires it to move quickly as supplies will become increasingly uncertain.

The total project is divided into two phases. In phase 1, Melcom will request technical assistance from its technology suppliers and investigate the changes needed to produce reliable CFC-free refrigerators. Limited production of refrigerators will be carried out for testing purposes. Testing will verify the reliability of the new models and answer questions about changes needed in the manufacturing process. Given the results of the phase 1 investigations, certain costs described below may not, in fact, be realized. In phase two, mass production of CFC-free refrigerators would begin. Reimbursement for incremental costs of making the conversion are requested here for phase 1 only.

PROJECT OBJECTIVE

1. Being the biggest refrigerator manufacturer in Malaysia, Melcom feels it is its duty to respond early in the phasing out of ODS, even though Malaysia is given a grace period in the phasing out of ODS.

2. Melcom must take more responsibility in the engineering conversion to ODS-free refrigerators compared to the other Matsushita sister companies in the Asean region due to limited manpower, time, and facilities at MEI to accommodate both their domestic requirements and requirements from the overseas plants.
   MEI believes that Melcom's technical capabilities are at present greater than those in sister plants throughout the region, so Melcom will have to take a stronger role in its phase out efforts.

3. This is an opportunity to grasp the technical knowledge and skill from MEI for Melcom's continuing manpower development.

SECTOR BACKGROUND

In the 1992 fiscal year, MELCOM-Bangi Plant produced 147,667 units of household refrigerators comprising 13 models. In producing the refrigerators, MELCOM-Bangi Plant consumed approximately 18.0 Tonnes of CFC-12, 80.6 Tonnes of CFC-11 and 11.3 Tonnes of 1,1,1 TCE. Hence, the total consumption of ODS was 109.9 Tonnes in that particular year. This figure represented 2.7 % of Malaysia's consumption of ODS, which in 1992, was approximately 4087 Tonnes of ODS.

ENTERPRISE BACKGROUND

MATSUSHITA ELECTRIC CO., (M) BHD. (MELCOM) was officially opened on 11th May 1967. MELCOM is public listed company. The major share holder (43.1%) is the parent company MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD JAPAN (MEI) and the rest of the share is held by the public.

At present, MELCOM is the most comprehensive manufacturer of electrical and electronic home appliances in Malaysia. The list of products being produced are as follows, colour television, refrigerator, washing machine, dry cell battery, electric fan, ventilation fan, rice cooker,slow cooker, blender, electric iron, gas cooker, home shower and vacuum cleaner. In 1992, the total sales revenue was RM 577 million (US$ 277 million). The export business accounted 32.1 % of the total sales and the rest from the domestic market. These products are being produced at four (4) different sites of factories. To increase it's production of refrigerators and washing machines to meet the growing demand, these departments were moved to the newly opened BANGI PLANT in June 1983.

The refrigerator department is the biggest refrigerator producer in Malaysia. The plant is producing an average of 13,000 sets of refrigerators per month for the domestic market only. This is about 51 % of the total refrigerator production in Malaysia. There are two (2) types of refrigerator being produced, namely the direct cool and frost free type. There are 13 different type of models being produced. In the manufacturing of refrigerators, 70 % of the parts are locally produced. Currently the NATIONAL brand is holding 35 % of the total refrigerator market share. (Total sales of locally made plus imported by all brand).

To ensure a continuously supply of good quality refrigerators to our consumers, it had been the policy of MELCOM as a whole, to strongly emphasize on the development of manpower before product. MELCOM has a TECHNICAL AGREEMENT with the parent company to ensure continuous availability of technical backup and assistance. In producing the NON-CFC refrigerators, the Refrigerator department is taking the initiative to start the development together with the parent company and at the same time developing the local staff's technical capabilities.

Melcom's technical agreement with MEI is slightly different from those between other Asian refrigerator manufacturers and their Japanese

parent companies. Given the technical capabilities of the Malaysian company, much of the product development and testing of new CFC refrigerator models has taken place in Malaysia, a practice that is consistent with the goverment's policy of increasing the technical capabilities of Malaysian firms. The development and testing of CFC-free models will continue this practice. Melcom's refrigerator models are distinct from those produced by MEI for the Japanese market, and although MEI will provide considerable technical support, much of the responsibility for the development of the CFC-free models is Melcom's.

As part of the existing technical agreement, Matsushita Refrigeration Company of Japan will do the following at no cost to Melcom :-

a) Design the different refrigerator models.
b) Provide production drawing for the new models.
c) Provide training on manufacturing, engineering and quality control.
d) Conduct the various approval tests for each refrigerator model.

PROJECT DESCRIPTION

This project is designed within the framework of the Montreal Protocol as an international agreement to reduce ODS consumption. Thus with the successful completion of the project, the use of CFC-12, CFC-11 and TCE 1,1,1 will be phased out in the household refrigerator manufacturing at Melcom Bangi Plant.

The total project can be classified into two different phases. The 1st phase is to verify chosen CFC-free technologies for the manufacturing of refrigerators and answer question about their reliability and manufacturability. The 2nd phase will be the mass production of CFC-free refrigerators, during which the actual incremental cost could be correctly verified.

Most of the incremental costs of making the conversion to CFC-free models are related to testing the reliability of the refrigerant circuit and the overall performance of the new models. Melcom anticipates relatively small costs for converting to HCFC-141b blown foam as the existing foaming equipment is only 3 years old and can be used with minor modification. It may be necessary to purchase a preheating oven for the door and cabinet lines. Whether this is necessary will be verified during the trial model testing. Some changes in ventilation equipment will also be required. Similarly, the costs of eliminating the use of 1,1,1 trichloroethane in the "Plate Water Evaporator" production step are expected to be small.

Melcom currently purchase its compressors from Matsushita Refrigeration Industries (Singapore) Pte Ltd.), in short (Maris). Maris had developed the HFC 134a compressors used in our initial system test in 1993. Maris will manufacture these compressors for our monitoring and limited production sets by April 1994.

Mass production of these compressors for our refrigerator production will start towards the end of 1995. Basically the compressor manufacturer will conduct tests on compressor performance and reliability only on the compressor itself. The lifetime of a compressor used in an appliance is not only affected by the durability of the compressor itself, but also depends on the operating conditions which are related to the design of the refrigeration system.

The complete refrigeration system performance and reliability using the new compressor must be confirmed by Melcom. The HFC 134a compressor oil has high hygroscopicity compared with conventional refrigerant oils. Therefore a total product assurance based on actual manufacturing process under high humidity and high ambient temperature is necessary.

Melcom's conversion to CFC-free refrigerator production is already underway and some of the cost of activities described below have already been incurred. To aid the reader, those cost incurring before January 1, 1994 are identified.

1. **Phase 1 components**

Training - As part of its Costing Technical Assistance Agreement with MEI, Melcom receives free of charge training in Malaysia and Japan. Melcom bears only the cost of airfare and accommodation. MEI plans to conduct training in Japan simultaneously with training of staff from other overseas locations.

To receive the knowledge through meetings, seminars and trainings at both local and overseas, these activities will be carried out throughout the project period.

a) Attending Non-CFC product development meeting in MEI (Japan) with all Matsushita Overseas Refrigerator manufacturing plant advisers and managers. This is carried out twice a year throughout the project period.

Anticipated Cost	US$	27,118.11
Incurred prior to 1st Jan 1994	US$	4,708.66

(See annex 2 for detailed estimated cost and schedule)

b) Sending and receiving refrigeration system specialist to MEI and MELCOM for training as required by the project.

Anticipated Cost	US$	30,086.58
Incurred prior to 1st Jan 1994	US$	10,594.35

(See annex 2 for detailed estimated cost and schedule)

c) Sending and receiving production and Q.C engineers and specialist to MEI and MELCOM for training as required by the project.

Anticipated Cost	US$	64,102.36
Incurred prior to Jan 1994		11,327.55

(See annex 2 for detailed estimated cost and schedule)

2. Purchase and set-up testing facilities in order to verify the performance, reliability and durability of the refrigeration system. These will be done in the factory premise with additional monitoring at actual homes (Practical usage).

a) Trial Testing Equipment

For each new CFC-free models, Melcom must make testing sample refrigerators to determine the correct sizing of refrigeration system. (Compressor; Condenser; Evaporator and Capillary tube). This is initial testing requirement.

The above equipment can later be used in the actual production of NON-CFC refrigerators.

Detail :-	Qty
1) Halogen Leak Detector	1 set
2) Leak Standard	1 set
3) Vacuum Pump	1 set
4) Freon Gas R-134a	1 cylinder
5) Dryer	20 pcs
6) Seal Valve (PCV-630-2P)	20 pcs
7) Seal Valve (SGP-400-2F)	20 pcs

* Purchased : April 1993 Total Cost US$ 19,660.77

b) Testing Room

Currently Melcom has 2 testing rooms that can accommodate a maximum of 25 Units of refrigerator. However for this project, during the peak time of testing, 96 sets of refrigerator need to be tested. Additional testing room capacity is needed because of the magnitude of the change to CFC-free refrigerators. As noted above, Melcom currently produces 13 refrigerator models. Past practice had been to introduce a new model every one or two years. The testing rooms were in more or less continuous use during this period but were adequate because only one or at most two models were being intensively tested at a time.

In making the switch to CFC-free models, Melcom plans to convert seven models by the end of 1995. We need to develop a minimum of 7 models in order to meet the market demand on the various range of refrigerator. In actual case, our marketing section requested the same range of model by 1995 with 134a system, however due to our capability and cost constraint we can develop only 7 models by 1995. This requires additional test room capacity. The alternative of converting one model at a time so that the testing room constraint is not reached will take too long. At the same time the present testing room could only be controlled at 32 C and 43 C, which are the standard test method. The new testing room will be able to be controlled at 15 C and 60 C as required by the new testing methods for reliability and durability.

The newly developed NON-CFC refrigerators must be tested continuously for a minimum of 2 years for durability test

Detail :-	Qty	Price
New Testing Room	2 Unit	US$ 433,070.87
* Completion : November 1993		==========

c) **Temperature Recorder** (At testing room)
Consistent with the additional of test room capacity and the need to test more sets simultaneously, Melcom must purchase additional temperature recorders. The numbers of recording points per set of refrigerator during testing is 6 points, which means during the peak period, 96 sets of refrigerator will require 594 testing points. Currently Melcom has 4 recorders with the total capacity of 102 recording points. We will purchase 15 recorders with a total capacity of 450 recording points. With this plan we will have a total capacity of 552 recording points. We will maximize the use of these temperature recorders.

These recorders will be used in the random sampling and monitoring of refrigerator durability performance.

Detail :-	Qty	Price
Hybrid recorder	15 Units	US$ 80,626.18
(30 Channel)		==========
* Purchased : April 1993		

d) **Temperature Recorder** (for monitoring at home user - actual usage monitoring)
For the above test, Melcom will select 120 customers for monitoring at various location in Malaysia. Only 34 out of total customers will be selected where each customer will have a recorder, monitoring the performance of the refrigerator. This recorder has only 2 recording point capability as the minimum testing requirement. The above test is to check the reliability and durability of the refrigerator in actual consumer settings.

This procedure will be the standard cycle used in the development of future NON-CFC refrigerator.

Detail :-	Qty	Price
Hybrid recorder	34 units	US$ 63,124.88
(2 Channel)		==========
* Purchased : April 1993		

e) **SURGE PROOF** (Lightning Test)
Surge Proof is the testing done to ensure the newly developed refrigerator can withstand the high surge current and voltage (2.0 kA @ 20 sec. & 4.4 kV @ 50 sec).
The newly developed refrigerator is susceptible to moisture; because the oil in the compressor has a very high moisture absorption rate. This in turn can result in current leakage.

Since the compressor motor is in the same casing as the compressor, the chances of current leakage is higher compared to the present type of compressor. In order to ensure the safety of the newly develop refrigerator, high current and high voltage tests must be carried out.
This equipment will be used to ensure product reliability and durability by random sampling.
This surge proof test will be conducted using Marco Japan testing facilities at no cost to Melcom.

f) **VIBRATION TEST**
Vibration test is carried out to ensure the endurance of the finished product at very severe vibration condition.

This testing will examine the fittings or the absorption capability of the product and it's components (eg: to test the mounting of the newly developed compressor to the refrigerator.)

This equipment will be used to ensure product reliability and durability by random sampling.

The vibration test anticipated earlier will be replaced by actual transportation test so costs of vibration tester are omitted.

g) **Scope camera & Accessories**
The Scope Camera is use for monitoring the level of the compressor oil in the compressor. Oil return to the compressor depends on the design of the refrigeration piping system; as such this test will determine that a good refrigeration piping system has been designed.

This equipment will be used to ensure product durability and reliability by random sampling.

Detail :-	Qty	Price
Scope & Camera	1 set	US$ 9,448.82
* Purchased : December 1993		==========

h) **Moisture Detector**
The Moisture Detector is used for monitoring the moisture content of the refrigerator's cooling system.
The newly developed refrigerator is susceptible to moisture; this in turn can result in the cooling system being chocked and finally the break down of the refrigerant flow.
This equipment will be use for the random sampling for the above test during the mass production for product quality assurance.

Detail :-	Qty	Price
Moisture Detector	1 set	US$ 39,370.08
		==========

i) Moisture & Dust Equipment
To analyse the oil and gas for any form of impurities and contamination. Due to the susceptibility to moisture and the possibility of dirt contamination during handling, we need to analyse the oil periodically using a random sampling method to ensure the purity of the oil.
This sampling test will be carried out even after the introduction of NON-CFC refrigerators.

Detail :-	Qty	Price
Moisture and Dust Equipment.	1 set	US$ 78,740.16

J) **Miscellaneous Testing Meter And Facilities**
The Miscellaneous testing meter and facilities is for the construction of new testing room and the connection to the temperature recorders.

(eg. thermocouple wire)	Price
* Purchased : April 1993	US$ 52,533.05

3. Testing of CFC-free models : As part of its technical agreement, MEI will test in Japan trial refrigerators produced by Melcom. Melcom is responsible for the cost of producing the refrigerators and for freight charges but pays no cost for the testing. As detailed below and in Annex 2, Melcom is requesting reimbursement for these costs only.

a) Refrigeration system testing (Using HFC-134a) in order to verify the above system many testing sample are required

MOCK-UP TESTING - 0 set (Except model A13= 3 sets)
To check the refrigeration (Except model B33= 3 sets)
sizing

PERFORMANCE TESTING
To confirm the basic - 3 sets
performance is achievable

RELIABILITY & DURABILITY - 11 sets
TESTING

FIELD MONITORING - 0 SET (Except model A13=20 sets)
(Except model B33=100sets)

SAMPLE TO JAPAN - 3 SETS
To check and confirm by MEI

PILOT PRODUCTION - 10 SETS
Standard requirements
before production

PRE-PRODUCTION - 10 SETS
Standard requirement
before production

TOTAL 37 SETS/MODEL
==========
(Except model A13 = 60 SETS)
(Except model B33 =140 SETS)

Total Cost US$ 248,654.89
==========

b) **POLYURETHANE FOAMING USING HCFC-141b**
To change to the foaming agent HCFC-141b, the material of parts that are in contact with the Polyurethane foam have to be changed so that they are compatible.

Examples of such parts are, Inner Liner (Inner refrigerator body) and cap-door sash. Currently other material are being studied, such as the wire cords.

Based on extensive preliminary study at Melcom and at its components suppliers minimum modifications are required to the foaming line. Only minor modification is needed to the foam injection equipment as this equipment is new. However a pre-heating oven for the Polyurethane foaming process might be required (See 4.e below).

What is also required in this project is extensive testing and verification of the production of the polyurethane foam using HCFC-141b . The manufacturing variables will need to be watched out during this testing stage. Melcom's refrigerator are different in size and shape from refrigerator made by MEI. As such testing is required on every models. Materials and parts are required in order to carry out the testing. Local conditions such as temperature, humidity, and different production equipment affect the result and must be studied.

Total Cost US$ 77,468.30
==========

c) **ELIMINATE THE USE OF 1,1,1 TCE**

The 1,1,1 TCE was used as a cleaning solvent for our refrigerator parts (condensor oil, plate water evaporator). These items after cleaning were coated with blue paint and black paint by an auto dipping process. They were then dried in an oven. These process was done through the conveyor system. This equipment was fabricated in 1983. With the elimination of 1,1,1 TCE tank the whole structure was totally dismantled and a smaller oven was fabricated for the purpose of drying.

Evaporator Coil

Melcom had decided that since Marcot (Matsushita Thailand) is being identified as the base for manufacturing of evaporator coil in this region, Melcom will stop its evaporator coil line. However Melcom is required to conduct the suitability study and testing to match to the evaporator coils made by Marcot. Costs involved are the refrigerator sample to be made.

Total Cost	US$	19,861.20

Evaporator Coil Oven

Upon receiving the Marcot evaporator coil, we carry out the various joints pipes brazing and leak inspection in water tank, follow by drying process in the oven. After that the layer of lacquer paint is apply to the brazing area. It is than dried in the oven at a temperature of 160 C for 30 minutes.

Details:-
Evaporator Coil Oven

	Price
US$	12,141.73

Plate Water Evaporator

This is a pressed metal part with steel tubing attached to it. This is part of the condenser use as a mean to vapourise the defrosted water collected in the collector pan. This part requires black painting process before which cleaning using 1,1,1 TCE is necessary. Melcom had decided to shift the production of this item to outside supplier. The supplier will be using degreasing pre-treatment process (parco cleaner & zinc phosphating) followed by black paint dipping process.
Melcom had dismantle the 1,1,1 TCE and black paint dipping tank, thereby omiting the usage of 1,1,1 TCE. It was completed on 16 November 1993

Dismantled the 1,1,1 TCE and black dipping tank	US$	4,940.94

*** Completion : November 1993**

4) **Production facilities**

These are the actual machines or equipment that will be used in the mass production of CFC-free refrigerators.

a) **Gas Charging Machine**

This machine is used in the production line for the charging of refrigerant gas into the refrigerator's system.

Present machine cannot be used for the new refrigerant because the latter is already contaminated with R-12 that is impossible to be purged out completely (the new refrigerant is R-134a).

This machine will be used 100% on the production line during the mass production.

Detail :-	Qty	Price
Gas Charging Machine	1 set	US$ 173,228.35

b) **Vacuum Pump**
To create a vacuum condition before refrigerant is charged into the refrigeration system.

Present vacuum pumps are already contaminated with R-12 which cannot be purged totally from the system, so we must purchase new sets of vacuum pumps in order to carry out the vacuuming process.

This is an unavoidable purchase whereby the usage of these pumps will be 100% during mass production.

Detail :-	Qty	Price
Vacuum pumps	35 units	US$ 62,598.43

Note :- Base on the Master Plan schedule (ANNEX 1) there will be an overlapping period (1995) when both CFC and NON-CFC models will be produce. Our study had showed that no change to our production conveyor system is required. Currently we use a mixed production system and the same will be applied during this overlapping period. Only our production planning and control has to be strengthened.

c) **Seal valve & socket**
It serves as a "coupling" from the joint between the refrigerator pipes and the vacuum pump. Currently the total number of these parts used in the production is 350 Units.

These present couplings are already contaminated with R-12, so we need to replace them with new ones.

The new couplers will be used fully during mass production.

Detail :-	Qty	Price
Seal valve & Sockets	350 pcs	US$ 14,960.63

d) **Assembly Process Room**
This room is to house the assembly process of compressor to the refrigeration piping and to keep dryers and joint pipes. Moistures is identified as the main source of problems with HFC-134a refrigeration systems. In the Melcom-Bangi Plant, humidity is found to reach to a maximum of 95%. The room will have controlled humidity features and operate at all times during production days.

Detail :-	Qty	Price
Part Storage Room	1 Room	US$ 39,370.08

e) **Oven for Door and Cabinet**
(Urethane Line)
To increase the temperature of the Refrigerator Doors and the Cabinets to 40 C.

The present R-11 has a boiling temperature of 23 C but the new R-141b boiling temperature is 32 C. Realizing this condition we need to pre-heat the Doors and Cabinets to a temperature of at least 40 C prior to Urethane charging in order to get a good reaction time and avoid the possibilities of defectives.

Detail :-	Qty	Price
Oven for Door And Cabinet	1 Each	US$ 19,685.04

f) **Ventilation system for Urethane Foam Chemical Mixing Room.**
To install ventilation system in the chemical mixing room. This is due to the light flammability of HCFC 141b. HCFC 141b vapour is heavier than air and tends to stay in low places. Therefore these places will be adequately ventilated to prevent excessive exposure or build-up of vapour.

Detail :-	Qty	Price
Ventilation system for Urethane Foam Mixing Room	1 Each	US$ 15,000.00

Phase 2

1) Mass Production
The incremental Cost will be calculated after the mass production begins in 1995.

2) Next Development of new NON-CFC Refrigerator.
Cost on this subject is not included in this proposal.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY AND EQUIPMENT INVESTMENT

Present ODS - CFC 12

Alternative - HFC 134a

Justification - HFC 134a has no ODP and is the alternative refrigerant of choice of refrigerator manufacturers worldwide, including Matsushita. Its use is recognized and approved by the UNEP Technical Committee on Refrigeration and Air Conditioning and the World Bank's OORG.

Present - CFC 11

Alternative - HCFC 141b

Justification - HCFC 141b is an interim alternative to CFC 11 blown PU foams. It has lower ODP than CFC 11 and can be used by Melcom with relatively minor equipment modifications and testing.

HCFC 141b is also the substitute chosen by Matsushita in Japan. A eventual transition to other alternatives such as cyclopentane, will be required but Melcom believes that to convert its facilities now would be premature, particularly since little cost will be incurred in adopting HCFC 141b technology as an interim measure.

Present ODS -1,1,1 TCE

Alternative - water soluble oil

Justification - The conversion to a water soluble oil by Melcom's parts suppliers will eliminate the need to use chlorinated solvents for cleaning metal parts at Melcom. There will be minimal environmental effects of converting to a water soluble oil as the wash effluent will be sent to treatment facilities inspected by Department of Environment.

PROJECT COST

Total Project Cost

The total project cost is US$ 1,585,791.45

This is the accumulation of Phase 1 cost.

INVESTMENT COST

Total investment cost

The total investment cost is US$ 1,585,791.45

This is the accumulation of Phase 1 cost.

OPERATING COST

Not Determined
(No request is made here for operating costs.)

UNIT ABATEMENT COST (UAC)

Not Determined

PROPOSED OTF GRANT

The propose OTF GRANT is US$ 902,315.33 and was calculated based on the investment cost and multiplied by the percentage of Malaysian ownership (56.9%)

FINANCIAL AND ECONOMIC ANALYSIS

Economic internal rate of return (ERR)
To be completed by DOE or the World Bank

Financial internal rate of return (FRR)
To be completed by DOE or the World Bank

FINANCIAL STATUS OF ENTERPRISE

To be completed by DOE or the World Bank

FINANCIAL PLAN

To be completed by DOE or the World Bank

PROJECT IMPLEMENTATION

Management

The Malaysian DOE will oversee the successful implementation of this project.

Schedule

Refer to ANNEX 1

Procurement

To be completed by DOE or the World Bank

Disbursements

To be completed by DOE or the World Bank

Audits

To be completed by DOE or the World Bank

REQUIRED REGULATORY ACTIONS

No regulatory actions, other than routine permitting, are required to implement this project.

Results

Direct Project Impacts

The project will eliminate 18.0 Tonnes of CFC-12, 80.6 Tonnes of CFC-11 and 11.3 Tonnes of 1,1,1 TCE each year based on 1992 production.

Indirect Project Impacts

Technology transfer from MEI to Melcom, thereby increasing the technical capabilities of Melcom staff.

ENTERPRISE COMMITMENT

DOE has confirmed with executives of Melcom that the enterprise is committed to undertaking the project described above that funds are approved and available as scheduled.

ANNEXES

ANNEX 1	Master Plan schedule
ANNEX 2	Phase 1 detail investment
ANNEX 3	Phase 2 detail investment
ANNEX 4	Summary of total investment
ANNEX 5	Technical Agreement
ANNEX 6	Company Brochures

Propose By,

MATSUSHITA ELECTRIC CO., (M) BHD.
(MELCOM)

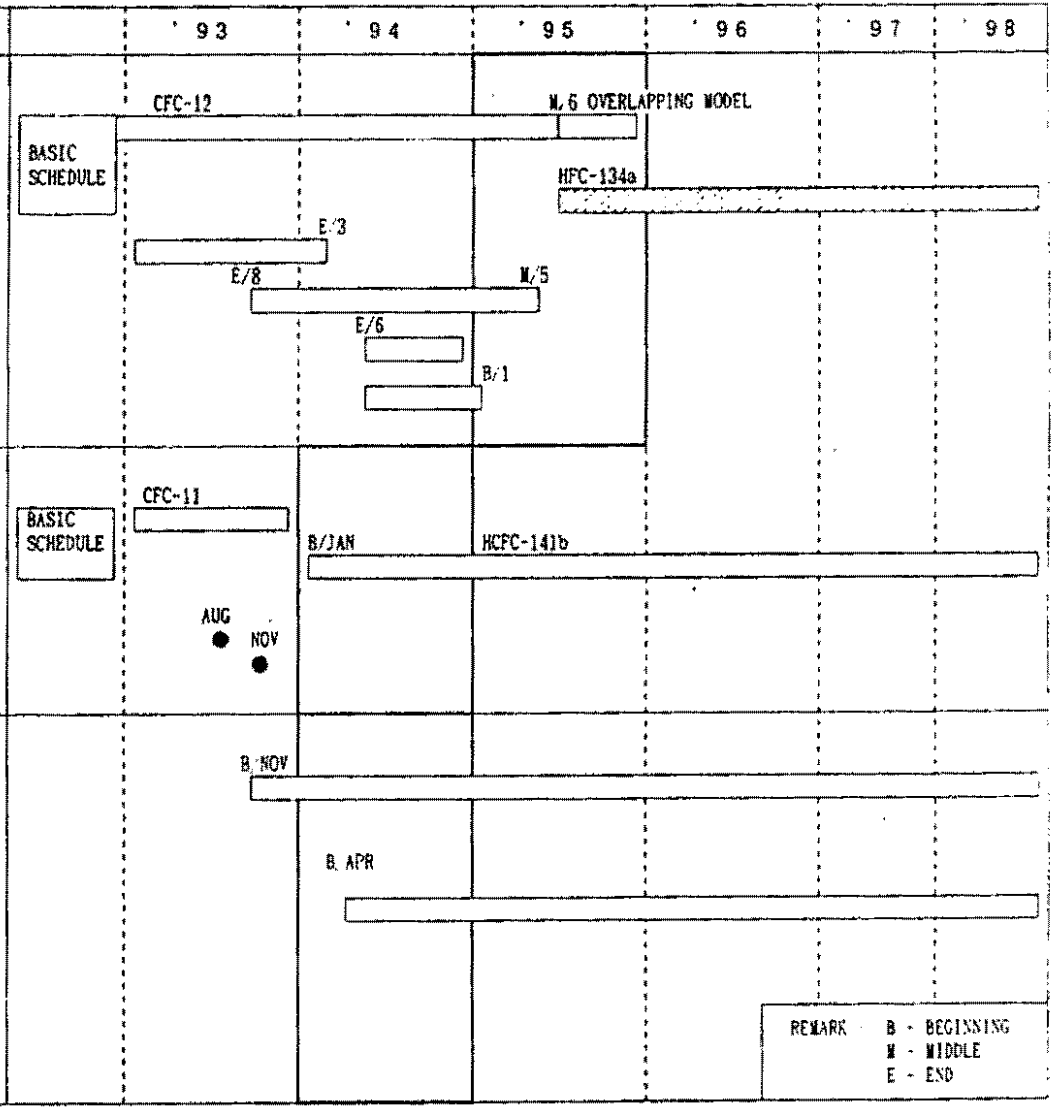
ANNEX 1

MELCOM-BANGI PLANT

MELCOM-BANGI PLANT'S NON CFC MASTER PLAN

03-08-93

PRESENT	NEW	USAGE	SUBJECTS OF ACTION
CFC-12	HFC-134a	REFRIGERATOR COOLING SYSTEM	1. CFC-12 2. HFC-134a i) TRIAL TEST ii) RELIABILITY TEST iii) DESIGNING iv) PRODUCTION FACILITIES
CFC-11	HCFC-141b	POLYURETHANE INSULATION	1. MATERIAL TESTING IN JAPAN - ABS SHEET;ABS INJECTION - POLYURETHANE FORMING 2. TRIAL TEST IN MELCOM - 1st TRIAL - 2nd TRIAL
1.1.1. TCE	WATER SOLUBLE OIL	a)PLATE WATER EVA b)EVA COIL	a. TO CHANGE FROM INHOUSE TO OUTSIDE SUPPLYER (THE SUPPLYER CHANGE 1.1.1 TCE TO VAPORIZE OIL b. TO CENTRALISE COIL MANUFACTURE - BY MARCOT



TC 035g

ANNEX 2

PHASE 1

INVESTMENT FOR DEVELOPMENT OF NON CFC REFRIGERATOR

03/08/93

MELCON-BANGI PLANT

ITEM	PHASE	SANCTION NO.	RECEIVE NO DATE	1993		1994		1995		REMARK
1) DISCUSSION · EVALUATION · TRAINING	PHASE 1									
A) ADVISOR AND MANAGERS				1 WEEK (2 PERSON) (2 TIMES)	9,039.37	1 WEEK (2 PERSON) (2 TIMES)	9,039.37	1 WEEK (2 PERSON) (2 TIMES)	9,039.37	
A) JAPANESE ENGINEER TO MALAYSIA FOR EVALUATION	PHASE 1			FEB'93(1 WEEK) APR'93(1 WEEK) AUG'93(1 WEEK) SEPT93(1 WEEK) OCT'93(1 WEEK) DEC'93(1 WEEK) (1PERSON/TRIP)	2,362.20 2,362.20 2,362.20 2,362.20 2,362.20 2,362.20	OCT'94(2 WEEK) (1 PERSON)	3,232.28	FEB'95(1 WEEK) (2 PERSON) MAY'95(2 WEEK) (1 PERSON) JUN'95(1 WEEK) (2 PERSON)	4,724.41 3,232.28 4,724.41	
C) LOCAL ENGINEER TO JAPAN FOR TRAINING	PHASE 1			JAN'93(2 WEEK) JAN'93(1 WEEK) APR'93(6 WEEK) MEI'93(4 WEEK) JUNE'93(8WEEK) JULY'93(1WEEK) SEPT'93(1WEEK) (1PERSON/TRIP)	3,017.72 2,259.84 6,049.21 4,533.46 7,564.96 2,259.84 2,259.84	MAR'94(1 WEEK) (2 PERSON) APR'94(1 WEEK) JULY'94(1WEEK) SEPT'94(1WEEK) (4PERSON/TRIP)	4,519.69 9,039.37 9,039.37 9,039.37	MAR'93(1 WEEK) (2 PERSON)	4,519.69	
TOTAL (US$)					51,157.44		43,909.45		26,240.16	

REMARK:

1) FOR MELCON STAFF TO JAPAN
   A) DAILY ALLOWANCE FOR 1 PERSON IS US$ 35.43
   B) HOTEL ALLOWANCE FOR 1 PERSON IS US$ 72.83/NIGHT
   C) AIR TICKET FOR 1 PERSON IS US$ 1,181.10
   D) OUTFITTING ALLOWANCE FOR 1 PERSON IS US$ 393.70/TRIP

2) FOR JAPAN STAFF TO MELCON
   A) DAILY ALLOWANCE FOR 1 PERSON IS US$ 45
   B) HOTEL ALLOWANCE FOR 1 PERSON IS US$ 78.74
   C) AIR TICKET FOR 1 PERSON IS US$ 1,574.80

CFC019c

ANNEX 2

MELCOM-BANGI PLANT

INVESTMENT FOR DEVELOPMENT OF NON CFC REFRIGERATOR

03/08/93

ITEM	SANCTION NO. 21/92/142	RECEIVE NO DATE	1993		1994		1995	
PHASE 1								
2) TESTING EQUIPMENT								
A) TRIAL TESTING EQUIPMENT	21/92/142A	15/4/93	APR' 93	19,660.77				
B) NEW TESTING ROOM (2 UNITS)	21/92/142B		① JUL' 93 ② MAY' 93	433,070.87				
C) TEMPERATURE RECORDER (TEST ROOM) (15 UNITS)	21/92/142B	20/4/93	APR' 93	80,626.18				
D) TEMPERATURE RECORDER (MONITORING) (34 UNITS)	21/92/142B	20/4/93	APR' 93	63,124.88				
E) SCOPE CAMERA & ACESSORIES (1 SET)			SEPT' 93	9,448.82				
F) MOISTURE DETECTOR					1994	39,370.08		
G) MOISTURE & DUST EQUIPMENT					(SEPT' 94)	78,740.16		
H) MISCELLANEOUS TESTING METER AND FACILITIES	21/92/142C		JUN' 93	52,533.05				
TOTAL (US$)				658,464.57		118,110.24		

ANNEX 2

PHASE 1 INVESTMENT FOR DEVELOPMENT OF NON CFC REFRIGERATOR

03.08.93

MELCON-BANGI PLANT

ITEM	SANCTION NO.	RECEIVE NO DATE	1993		1994		1995
3) a) TESTING FOR HFC-134a							
NR-A13BM @ $ 366.93			(40 UNITS)	14.677.20	(20 UNITS)	7.338.60	
NR-A16BM @ $ 395.28			(17 UNITS)	6.719.76	(20 UNITS)	7.905.60	
NR-A19BM @ $ 478.74			(17 UNITS)	8.158.58	(20 UNITS)	9.574.80	
NR-B20BDM @ $ 511.42			(17 UNITS)	8.694.14	(20 UNITS)	10.228.40	
NR-B25BFM @ $ 706.70			(17 UNITS)	12.013.90	(20 UNITS)	14.134.00	
NR-B33AFM @ $ 711.42			(120 UNITS)	85.370.40	(20 UNITS)	14.228.40	
NR-B43AFM @ $ 870.08			(17 UNITS)	14.791.36	(20 UNITS)	17.401.60	
RETURN SET @ $ 272.69			(21 UNITS)	5.726.49	(14 UNITS)	3.817.66	
MISCELLANEOUS TESTING OR CHARGES				3.937.00		3.937.00	
TOTAL (US$)			(266 UNITS)	160.088.83	(154 UNITS)	88.566.06	

CFC18

ANNEX 2

PHASE 1 INVESTMENT FOR DEVELOPMENT OF NON CFC REFRIGERATOR

03/08/93

MELCON-BANGI PLANT

ITEM	D/O NO.	1993		1994		1995	
3) c) TESTING FOR HCFC-141b							
i) INJECTION MATERIAL @ 8.74		3250 KG	28.405.00				
ii) EXTRUSION MATERIAL @ 0.87		26.000 KG	22.620.00				
iii) HCFC-141b @ 71.15		20 KG	1.423.00				
iv) CABINET & DOOR W/O FOAM							
A5AM @ 11.65		30 UNITS	349.50				
A13BM @ 29.40		45 UNITS	1.323.00				
A16BM @ 32.01		30 UNITS	960.30				
A17BM @ 32.80		30 UNITS	984.00				
A19BM @ 38.26		30 UNITS	1.147.80				
B18ADM @ 71.37		30 UNITS	2.141.10				
B20BDM @ 62.95		30 UNITS	1.888.50				
B21BFM @ 76.83		30 UNITS	2.304.90				
B25BFM @ 81.56		30 UNITS	2.446.80				
B30BFM @ 125.11		30 UNITS	3.753.30				
B33AFM @ 93.16		45 UNITS	4.192.20				
B43AFM @ 117.63		30 UNITS	3.528.90				
TOTAL (US$)			77.468.30				

CFC018k

ANNEX 2

PHASE 1 INVESTMENT FOR DEVELOPMENT OF NON CFC REFRIGERATOR 03/08/93

MELCOM-BANGI PLANT

ITEM	D/O NO.	'93		'94		'95	REMARK
3) d) TESTING TO OMIT 1,1,1 TCE							
i) COIL EVAPORATOR (MARCOT)							
NR-B21BFM @ 396.24		15 UNITS	5,943.60	9 UNITS	3,566.16		
NR-B25BFM @ 431.31		15 UNITS	6,469.65	9 UNITS	3,881.79		
ii) DISMANTTLE OF TCE 111 TANK							
AND BLACK PAINTING TANK		1 UNIT	4,940.94				
TOTAL (US$)			17,354.19		7,447.95		CFC047b

ANNEX 2

MELCOM-BANGI PLANT

INVESTMENT FOR DEVELOPMENT OF NON CFC REFRIGERATOR

03/08/93

ITEM	SANCTION NO. 21/92/142	RECEIVE NO DATE	1993		1994		1995	
PHASE 1								
4) PRODUCTION FACILITIES a) GAS CHARGING MACHINE					JUN' 94	173,228.35		
b) VACUUM PUMP (35 UNITS)					JUN' 94	62,598.43		
c) SEAL VALVE & SOCKET (350 UNIT)					JUN' 94	14,960.63		
d) ASSEMBLY PROCESS ROOM					JUN' 94	37,370.08		
e) NEW OVEN COIL DRYING					JAN' 94	12,141.73		
TOTAL (US$)						302,299.22		

CFC171

ANNEX 3

MELCOM-BANGI PLANT

INVESTMENT FOR DEVELOPMENT OF NON CFC REFRIGERATOR

03/08/93

ITEM	SANCTION NO. 21/92/142	RECEIVE NO DATE	1993		1994		1995	
PHASE 2								
1) PRODUCTION FACILITIES								
a) OVEN FOR DOOR & CABINET URETHANE			SEPT' 93	19,685.04				
b) VENTILATION SYSTEM FOR URE. FOAM						15,000.00		
TOTAL (US$)				19,685.04		15,000.00		

CFC!

ANNEX 4

MELCOM-BANGI PLANT

SUMMARY OF NON CFC REFRIGERATOR INVESTMENT

18/01/93

ITEM	SANCTION NO.	RECEIVED NO.	'93	'94	'95	REMARK
PHASE 1						
1) DISCUSSION / EVALUATION / TRAINING			27,118.11	30,086.58	64,102.36	
a) MEETING IN JAPAN						
b) REFRIGERATION SYSTEM SPECIALISTS						
c) PRODUCTION AND Q.C SPECIALISTS						
2) TESTING EQUIPMENT			658,464.57	118,110.24		
a) TRIAL TEST EQUIPMENT						
b) NEW TESTING ROOM						
c) TEMPERATURE RECORDER(TEST ROOM)						
d) TEMPERATURE RECORDER(MONITORING)						
e) SURGE PROOF TESTER (OMITTED)						e)SURGE PROOF TEST TO BE CARRY OUT IN MARCO JAPAN
f) VIBRATION TESTER (OMITTED)						f)VIBRATION TEST TO BE REPLACE BY ACTUAL TRANSPORTATION TEST
g) SCOPE CAMERA & ACCESSORIES						
h) MOISTURE DETECTOR						
i) MOISTURE & DUST EQUIPMENT						
j) MISCELLANEOUS TESTING METER AND FACILITIES						
3) TESTING REQUIREMENT			254,911.32	96,014.01		
a) TESTING FOR HFC 134a						
b) TESTING FOR HCFC-141b						
c) TESTING FOR 1,1,1 TCE						
4) PRODUCTION FACILITIES				302,299.22		
a) GAS CHARGING MACHINE						
b) VACUUM PUMP						
c) SEAL VALVE & SOCKET						
d) ASSEMBLY PROCESS ROOM						
e) NEW OVEN COIL DRYING						
PHASE 2						
1) PRODUCTION FACILITIES						
a) OIL CLEANING & CHARGING M/C(OMMITED)						a) PURCHASE COMPRESSOR WITH OIL
b) OVEN FOR DOOR AND CABINET			19,665.04			
c) VENTILATION SYSTEM FOR URE. FOAM				15,000.00		
PHASE 3						
1) MASS PRODUCTION						
2) NEXT NEW MODEL NON-CFC DEVELOPMENT						TOTAL
TOTAL (US$)			960,179.04	561,510.05	64,102.36	1,585,791.45

CFC

ICI Polyurethanes

TELEFAX

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To Mr. K. Von Ritter

cc : Mr. T. Waltz

28th February, 1994

OORG REVIEW OF MELCOM'S PROJECT

The review follows. Please note that this refers to the foam elements of the project only.

Mike Jeffs

G. M. F. Jeffs - OORG MD 152
GMFJ/kd

MELCOM - MALAYSIA

SCOPE

The component of the project covered in this review is concerned with the replacement of CFC 11 in the production of refrigerator insulating foam by HCFC 141b.

RECOMMENDATION

The foam component of the project is approved subject to the resolution of the item on plastic liners. The refrigerant section of the project should be addressed by the appropriate OORG reviewer, Dr. L. Kuijpers.

RELEVANCY AND ADEQUACY OF INFORMATION PROVIDED

The foam-related elements of the project are well documented.

TECHNICAL SOUNDNESS

HCFC 141b-based technology gives good insulation values and is being adopted by Melcom's parent company. It use is recognised as an interim solution but it is cost effective since the UAC of foam-related items is 0.25 $/kg ODS/year of which approximately one third may be relevant to a future zero ODP technology.

The reviewer gives approval on the assumption that there will be adequate support on the plastic liner issue from the parent company. The enterprise should continue to investigate the applicability of zero ODP options including taking note of the recommendations of the OORG Refrigerator and Freezer Foam Working Group.

The requirement for a pre-heating oven should be investigated before purchase. In the reviewer's experience these have not proven necessary for HCFC 141b technology because foam to liner adhesion is improved relative to that with CFC 11 and the slight change in boiling point is not significant.

LESSON FROM EXPERIENCE

None.

ENVIRONMENTAL ISSUES

As mentioned above, the chosen technology has a residual ODP and must be considered as a transition phase solution.

SAFETY ISSUES

There is provision to improve ventilation to ensure fire safety when operating with HCFC 141b. There should be training / support from the parent company on this issue.

COST EFFECTIVENESS

Comments are covered above. The very low UAC associated with the transition phase (for the foam) is noted. The enterprise is already equipped with modern polyurethane dispensing equipment.

OTHER

None.

GMFJ/kd/28/2/94

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From Dr Lambert Kuijpers
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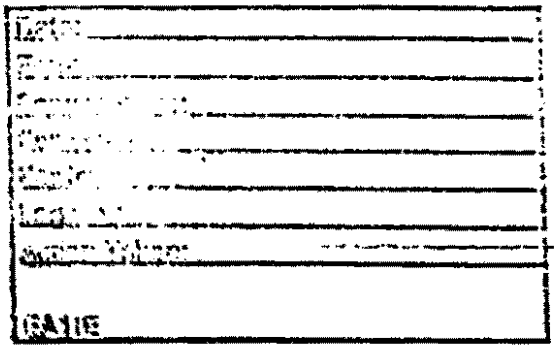

Date 94-03-01

Pages 3 (including this one)

Copy Waltz

Dear Konrad,

Please find attached the review of the melcom proposal.

Regards

Malaysia

REVIEW OF A HFC-134a CONVERSION PROJECT

Manufacture of HFC-134a Refrigerators at Matsushita El Co MELCOM Bangi

Project Proposal by The World Bank, February 1994 (II)

RTU-UNWB-LK-94278 -lk

Scope

The project under review covers two phases of the conversion to HFC-134a in refrigerators at Matsushita (MELCOM) Bangi in Malaysia, where the production level is 146,000 products per annum. Emphasis in the proposal is on the expansion of laboratory facilities and on the extended testing of refrigerators, and on the supply of moisture free components.
The first phase is in agreement with the phased approach recommended by the OORG; it also fulfills the requirement that HFC-134a technology assistance will be from a manufacturer that has commercialized the 134a product.

Recommendation

The project is supported, however,
this provided that the number of tests proposed are reconsidered/reduced or that adequate additional information on the necessity of the tests is given.

Relevancy and Adequacy of Information

- The proposal does give the necessary information where the supply from compressors will come from and what this will imply regarding tests that need/need not to be performed.
- Furthermore it is mentioned that the assistance from the compressor manufacturer is only related to compressor life tests.
- The proposal adequately describes the technology transfer contract with the Matsushita company, that will do design and additional testing free of charge.
- It is stated that technical assistance is being carried out via a number of visits of engineers to the Matsushita company in Japan, and a number of visits of an engineer from Japan. It is assumed that this can guarantee enough technical assistance (however, this type of technical assistance seems to be different from the ones other Matsushita based proposals).

Technical soundness

- With the assistance of the Matsushita company -and possibly a compressor manufacturer- the 134a development or redesign will not be substantially different from the usual CFC-12 development. Of course, specific aspects have to be checked; this appiles to the compressor manufacturer but also to the refrigerator manufacturer if specific manufacturing conditions prevail. The proposal explicitly mentions very high humidity in manufacturing.
- In principle, the proposal has a very sound character where it concerns reliability:
- - design and limited testing at Matsushita
- - checks of moisture/oil/design problems via monitoring (USD 130,000)
- - extended testing via climate rooms plus costs for prototypes and testing (USD 900,000)
- Normal practice -in the case of CFC-12- has been that appliances were extensively checked in a climate room (one to two models per two year). It would probably imply the extended testing of 20 samples per model for a longer period. Transferring this way of testing to the HFC-134a conversion yields a very high need of testing positions, given the development of 7 models in two years. It is not certain, whether this is required.
- Of course, an extra test facility for HFC-134a will be needed, certainly if other ambient temperatures have to be taken into account.

- However, given the fact that limited testing is done at Matsushita, redesigns (probably proven) come from the same company, extensive monitoring of all kind of effects such as moisture, oil levels etc. is done with new equipment (which was not common practice for CFC-12), it seems logical that the conventional reliability testing (at least the number of samples tested) can be reduced. This also because the model designs that will be converted will be comparable to each other (not completely different) to a certain degree.
- Taking into account a lower need for testing large amounts of samples, costs for the test rooms, the recorders and the prototypes/tests could be substantially reduced (e.g. by 50%). If MELCOM states that this will not be possible, a description is needed
- -why all models are completely different from each other (design)
- -why the amounts need to be so large, given the monitoring of all phenomena

This would imply a reduction in the total cost (which now amounts to about USD 900,000) for climate rooms, instrumentation and prototypes/testing.

It should be stated that the procedures proposed are very good, but may even be "over"guaranteeing reliability.

Lessons from experience

A project for Matsushita in Thailand (submitted in May 1993) gives a different idea of the way of testing (compressors provided) and the costs for technical assistance. It does not imply that the technical assistance as defined in the earlier proposal is the adequate one, the assistance and the testing in this proposal (which in a sense replaces direct technical assistance costs) can be as good (more experience locally) but should then have the same order of magnitude, financially spoken.

Environmental and Safety Issues

The use of HFC-134a is an acceptable way to reduce CFC-12 consumption.

Cost Effectiveness

Cost effectiveness cannot be discussed.
Costs for testing rooms (equipment) and for additional tests mainly for reliability (incl. compressor behaviour) are extremely high. Reduction of the number of tests, together with good logistics, could yield a substantial reduction.

Kuijpers, 1994 02 28

northern telecom

3 Robert Speck Parkway,
Mississauga, Ontario,
Canada,
L4Z 3C8

March 3, 1994

By FAX

Konrad von Ritter
The World Bank
8181 H Street, NW,
Washington, DC
20433

Ref: Malaysia Melcom Project

Dear Konrad

I have reviewed the latest proposal for converting Melcom to new refrigeration technology. My interest is the solvent aspects of the refrigeration manufacturing facilities.

I note with interest that Melcom has now sub contracted the manufacture of the plate water evaporator to an outside shop. This has resulted in Melcom ceasing its use of 1,1,1-trichloroethane (the previous proposal that I reviewed had the evaporator assembly manufactured using a water soluble oil followed by aqueous cleaning).

Accordingly I have no further comments regarding Melcom's elimination of ozone depleting solvents in this project.

I do however recommend that the company that is now manufacturing the plate water evaporators for Melcom be contacted to confirm that it is not using 1,1,1,-trichloroethane and that it is using water soluble oils. At the same time it should be determined if the subcontractor has other uses of ozone depleting solvents that require eliminating.

Regards,

Arthur D. FitzGerald
Director
Environmental Projects

cc: Tom Waltz -- World Bank/OORG

National/Panasonic
MATSUSHITA ELECTRIC CO., (M) BHD.

To : Mr. Konrad Von Ritter
Department I, East Asia Pacific
The World Bank
Washington D.C 20433, USA

From : Mr. T. Sasaki
Production Executive Director
Matsushita Electric Co., (M) Bhd
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Malaysia

Date : 28th. March 1994

Copy : Mr. Ismail Ithnin
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Kementerian Sains, Teknologi Dan Alam Sekitar
Tingkat 12 & 13, Wisma Sime Darby
Jalan Raja Laut
50662 Kuala Lumpur

Dear Sir,

RE : Justification MELCOM IMF Proposal February 16 Version

With reference to letter we received from Mr. Mark Radka on March 18, 1994 regarding the World Bank's OORG comments on the above proposal.

Here we would like to justify the following points :

A) PU Insulating Foam Component

1. Concerning the issue of incompatibility between HCFC-141b alternative blowing agent and refrigerator components. MELCOM had conducted extensive preliminary testing with its components suppliers Toyo Plastic Malaysia Sdn. Bhd. Our latest extrusion test on plastic Liner was on March 10, 1994.
Test result to date show no evidence of critical problems.
MELCOM will continue to investigate the issue of incompatibility both by continuing its dialogue with 1st Malaysia's suppliers and by verifying research results with MEI engineers.

2. Dr. Jeffs suggests that the purchase of the pre-heating oven may not be necessary due to HCFC-141b technology and slight change in boiling point.

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Below are the explanation on above requirement :

141b minimum boiling temperature	=	32 C
Mean ambient temp. in Bangi area :		
In the morning 0700	=	24.0 C
In the afternoon 1300	=	31.5 C
Temp. specification of Door Panel & Cabinet before charging	=	34 to 36 C
Actual door panel & cabinet temp. before charging in the morning	=	25 to 26 C
Urethane jig temperature specification for charging	=	40 to 45 C

From the above data, it is very clear that pre heating of door panel & cabinet must be done because :-

a) Ambient temperature in the morning is less than 141-b boiling temperature

b) Door panel temperature before charging is below specification

c) Although urethane jig temperature can be maintained at 42 - 45 C low temperature of panel will increase reaction time hence result in foam void and poor adhesion between PU foam & door panel surface.

B) Refrigeration Component

1. On Dr. Kujipers statement that why all models are completely different foam each other (design).
   Basically MELCOM is developing two different type of refrigeration system for the refrigerator. That is direct cool roll bond evaporator and frost free evaporator coil cooling fan type, a total of seven model of refrigerators.

Refrigeration System	Single Door Model	Twin Door Model
Frost Free	-	3
Direct Cool	3	1

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These Refrigerator with difference as follow :-

a) Refrigerator capacity varies from 130 litres to 430 litres

b) Cooling evaporator different sizes, Roll Bond type & Fin and Tube evaporator difference in design & construction.

c) Compressor difference capacity due to cooling capacity & related components matching.

d) Inner condenser length differences due to heat load capacity an surface area of heat dissipation on cabinet.

e) Refrigeration system balance by mean of varies length & sizes of capillary tube pressure losses.

2. Why the amount need to be so large (climate control room, instrumentation, proto type/testing) given the monitoring of all phenomena.

The development flow for non-cfc refrigerator cooling system for Melcom by our parent company in Japan. The six major steps are as follow :-

a) Study system design
cabinet heat load, condenser capacity & system volume.

b) Study gas amount
Gas charging test at ambient temperature 32 C & 43 C

c) Decided the best Capillary Tube and secondary Capillary Tube
Continuous running performance at 32 C & 43 C with various pressure drop.

d) Decided Capillary Tube
Recovery test at 32 C, RH 80% with the best capillary tube.

e) Estimate starting
I.P.D test at ambient 43 C

f) Arrange Reliability test sample
Discharge gas, motor winding, oil temperature at 38 C with 4 face enclose setting.
Flash gas possibility test & oil level checking

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MATSUSHITA ELECTRIC CO., (M) BHD.

Similarly each development step on non-cfc refrigerator must comply with varies test items.

a) Study cooling system (mock-up sample)
   Total 14 test item

b) Cooling performance testing (mock-up sample)
   Total 25 test item

c) Reliability test sample (monitoring fridge)
   Total 15 test item

d) Pilot run (Pilot production refrigerator)
   Total 60 test item

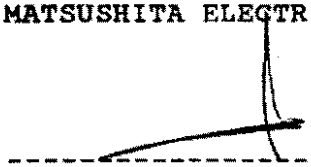
Inview of the above procedure in carrying the 7 models of non-cfc refrigerator development & production in Melcom.

The need on climate rooms, instrumentation, proto types/testing is the basic requirement in complying with the product quality & reliability of non-cfc refrigerator.

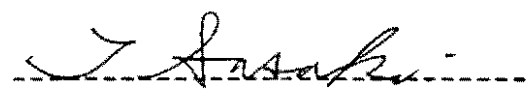
We sincerely hope your kind understanding on the matter will be highly appreciated.

Thank you and best regards

MATSUSHITA ELECTRIC CO., (M) BHD



Y. Shimizu
Refrigerator Senior Advisor
Bangi Plant



T. Sasaki
Production Executive Director
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