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

Seventeenth Meeting
Montreal, 26-28 July 1995

PROJECT PROPOSAL: PHILIPPINES

This document includes the following project proposal:

- Elimination of CFCs 11 and 12 in the Manufacture of Domestic Refrigerators at Matsushita Electric Philippines Corporation (MEPCO) — UNDP

PROJECT COVER SHEET

COUNTRY:	**PHILIPPINES**
PROJECT TITLE:	Elimination of CFCs 11 and 12 in the Manufacture of Domestic Refrigerators at MATSUSHITA ELECTRIC PHILIPPINES CORPORATION (MEPCO)
SECTOR COVERED:	DOMESTIC REFRIGERATION
ODS USE IN SECTOR:	420 tons ODS (1991)
PROJECT IMPACT (ODP):	47.05 ODP tons
TOTAL PROJECT COST:	USD 574,422
INCREMENTAL CAPITAL COST:	USD 202,000
INCREMENTAL OPERATING COST:	USD 372,422
PROPOSED MLF GRANT:	USD 114,884
UNIT ABATEMENT COST:	1.72 US$/Kg
COST EFFECTIVENESS:	11.16 US$/Kg
PROJECT DURATION:	1.5 years.
ECONOMIC LIFE:	10 years.
NATIONAL COORDINATING BODY:	Energy Management Bureau (EMB), Department of Environment & Natural Resources (DENR)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	April 1995

PROJECT SUMMARY:

MATSUSHITA ELECTRIC PHILIPPINES CORPORATION (MEPCO) is a 20% Philippines-owned JV enterprise with Matsushita Electric Company of Japan. MEPCO manufactured almost 90,000 domestic refrigerators and freezers in 1994 and 20% per annum growth in production is anticipated for the next two years. All sales are in the Philippines where the enterprise has a 22% market share. MEPCO presently uses CFC 11 in the production of rigid PU insulation foam for the refrigerator cabinets and doors and CFC 12 is used as the refrigerant. This project will eliminate CFC 11 consumption by conversion to HCFC 141b, and the CFC 12 will be replaced by HFC 134a. ODP consumption in the manufacture of refrigerators and freezers in 1994 was 51.46 ODP tons. Funds requested will be used to change the existing production lines, and for prototyping, trialling, testing, and training, etc. Incremental operational costs are requested for a period of SIX months.

Prepared by:	Stuart Kelly/Frans Voorwalt, in collaboration with the Department of Environment and Natural Resources(DENR).
Reviewed by:	L.J.M. Kuijpers/M.J.P.Janssen (Refrigeration) and H. Creyf (Foam). Their comments are attached.

PROJECT OF THE GOVERNMENT OF PHILIPPINES

ELIMINATION OF CFCs IN THE MANUFACTURE OF DOMESTIC REFRIGERATORS

1. PROJECT OBJECTIVE.

The objective of this project is to eliminate the consumption of CFCs used by Matsushita Electric Philippines Corporation (MEPCO) in the manufacture of a range of domestic refrigerators and freezers.

CFC 11 is used as the blowing agent for producing the PU thermal insulating foams for the refrigerator cabinets and doors. This will be eliminated by conversion to HCFC 141b. CFC 12, used as the refrigerant, will be replaced by HFC 134a.

2. SECTOR BACKGROUND.

The Philippine Country Programme (CP) for the Phase-out of Ozone Depleting Substances (ODS) under the Montreal Protocol was approved at the 10th meeting of the Executive Committee of the Multilateral Fund (MLF) in 1993.

The CP provides refrigerator production data for 1989 and suggests that at that time total local production of domestic refrigerators and freezers was around 400,000 units. Around 90% of production was sold in the local market. Imports were small at around 2,500 units (6% of local production).

By 1991, the CP estimates that CFC consumption in the manufacture of new domestic refrigrators was 285 tons of CFC 11 for the PU insulation foam, and 70 tons of CFC 12 for refrigerant. An additional 65 tons of CFC 12 was estimated as having been consumed for re-charge during service and maintenance of domestic refrigerators making a grand total of 420 ODP tons.

Five companies dominate local refrigerator manufacture and sales, although significant changes in the economic situation in the Philippines during the period 1989 to date, coupled with sometimes difficult labour relations problems, means that corporate market shares can change quite substantially in the short term.

In 1994 it is estimated that local manufacture of domestic refrigerators and freezers in the Philippines had grown to around 600,000 units per annum and total ODS consumption in this sector had reached 510 ODP tons. Only one company (Philacor), exports a part of its production, this is to the USA and the Middle East.

MEPCO, the subject of this MLF project proposal, sells all its refrigerators locally and in 1994 had a 22% market share.

The five major domestic refrigerator manufacturing companies in the Philippines are:

Philacor
Concepcion Industries Inc.
Trans-Union Inc. (formerly Federal Electric)
Sanyo Philippines
Matsushita Electric Philippines Corporation

Projects to eliminate ODS consumption at Philacor, Concepcion, Sanyo Philippines, and Federal Electric were approved by the MLF in 1993, with the World Bank as the Implementing Agency. These projects are still in the early stages of implementation.

ODS in the domestic refrigeration sector in 1991 was estimated to represent some 10.9% of total ODS consumption in the Philippines, or 15.8% of consumption when expressed in ODP terms. Growth in the sector, coupled with elimination of ODS consumption in other sectors, means that the sector share of ODS consumption in 1994 will be higher than in 1991.

The high production growth rates, both in the sector overall and specifically at MEPCO (20% p.a.), coupled with MEPCO's very significant market share, means that the elimination of ODS consumption at this enterprise now has a high priority in the Philippines ODS phase-out strategy.

MEPCO is actively pursuing their own programme for ODS elimination by the end of 1995. Approval of this project by the MLF in July 1995 will provide stimulus to the programme and will also eliminate any possible market distortion caused by the MLF approval of projects in 1993 for Philacor, Concepcion, Sanyo Philippines, and Federal Electric.

3. ENTERPRISE BACKGROUND

MATSUSHITA ELECTRIC PHILIPPINES CORPORATION (MEPCO), formerly Precision Electronic Corporation, is a Japanese - Filipino joint venture company established in 1967. Matsushita Electric Industrial Company Ltd. (MEI) of Japan owns 80% of MEPCO, with the remaining 20% owned by various Filipino entities.

MEPCO presently employs around 1,900 employees and is engaged primarily in the manufacture of a wide range of electrical home applliances carrying the Japanese parent company's "National" and Panasonic" brand names. Among its major production lines, MEPCO has an integrated SINGLE domestic refrigerator and freezer manufacturing facility at its Taytay, Rizal, plant near Manila operated by about 160 personnel. This facility includes in-house processes such as automated metal parts forming, plastic parts moulding, electrostatic body painting, PU foam injection, and refrigerant charging. A summary of relevant information follows:

ACTUAL CFC CONSUMPTION: Jan - Dec 1994	40.12 tons CFC 11 (manufacturing) 11.34 tons CFC 12 (manufacturing) 6.09 tons CFC 12 (service use)
FULL NAME:	MATSUSHITA ELECTRIC PHILIPPINES CORPORATION (MEPCO)
PLANT LOCATION:	Ortigas Avenue Ext., Bo. Mapandan, Taytay, Rizal 1901, Philippines
% ARTICLE 5 COUNTRY OWNERSHIP:	20% (Philippines)
No. OF MODELS:	10
PRODUCTION IN LAST 12 MONTHS:	88,486 units
No. OF PRODUCTION LINES:	1
COMPRESSOR SUPPLIERS:	Matsushita, Singapore (100%)
CONTACT PERSONS:	Orlando Jose L. David - Corporate Planning Department Lirio J. Bantayan - Corporate Planning Department Bart S. Sarangaya - Manager Refrigerator Department
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MEPCO produced its first refrigerator in 1977 with technology licensed from its parent company MEI, and provided by its affiliate, Matsushita Refrigeration Company Ltd (MARCO). There is ongoing provision of information on refrigerator technology developments under the licensing agreement and in using the "National" and "Panasonic" brand names, MEPCO has to meet the Japanese parent companies maufacturing and quality standards. Information and assistance on the conversion to the HCFC 141b and HFC 134a technologies to replace CFC 11 and CFC 12 are also being provided by MARCO. (See attached Annex C.).

It should be noted that in the selection of the currently available and developed CFC replacement technologies, all of the relevant issues were considered by MEPCO, including ODP, safety, cost, and technology transfer. In selecting HCFC 141b it is recognised that this is only an interim step which will require eventual replacement by an appropriate zero-ODP technology. Of particular importance to MEPCO is the relationship with Matsushita, and the technology selected by their Japanese parent company. This is presently HCFC 141b and hence this was a major contributing factor in MEPCO selecting the same technology.

Data from trials already conducted also shows that HCFC 141b technology can be introduced with both minimal investment cost, and minimal loss of production at the Taytay factory using the existing high pressure PU foam blending and dispensing machines.

Whilst cyclopentane technology could also be introduced with the provision of the necessary safety equipment, cyclcopentane storage and blending facilities, and retrofit of the existing foam dispensing machines, this option was not selected at the present time for a number of very valid reasons. These include the planned move of the refrigerator manufacturing operation to MEPCO's other factory site at Laguna Technopark, Bo. Don Jose, Santa Rosa, Laguna in 1997. The tentative plan is that the cyclopentane technology, or another proven appropriate zero-ODP technology, will be introduced to replace the HCFC 141b technology at that time. MEPCO understand that the costs associated with that technology change is for their own account.

With reference to the decision of the 15th meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol regarding project proposals employing HCFC 141b technology please refer to the attached letter from MEPCO in support of their technology selection (see attached Annex D.).

Commencing in October 1993, MEPCO have already conducted extensive trials and tests on HFC 134a prototype refrigerators in new purpose-built environment test chambers. They are unable to use the data from similar tests by their Japanese partner because of the significant climatalogical differences. Based on the results on this work MEPCO will embark on a pilot scale production run of 500 refrigerators using HFC 134a in June 1995 which will be the subject of a reliability study.

In order to meet this timetable, and the subsequent planned mass production conversion date of end 1995, MEPCO have already ordered a replacement HFC 134a refrigerant charging machine, plus some HFC 134a leak detection equipment and vacuum pumps. This means that if the project is approved, retroactive financing of at least part of the capital investment costs, and the eligible costs relating to prototyping, trialling, testing, pilot scale production and reliability test trials etc. will, therefore, be necessary.

MEPCO has 13 of its own service centres throughout the Philippines where there is consumption of CFC 12 in the repair and maintenance of refrigerators. These are located in Greater Manila Area (1), Luzon Province (6), and Visayaa/Mindanao Provinces (6), and TOTAL annual CFC 12 consumption is estimated at 6.09 tons per annum. Lack of information on the breakdown of consumption by service centre, and the absence of any estimate of the amount which might be recoverable, precludes consideration within this project proposal of, for example, recovery and recycle equipment as a means of reducing this ODS consumption.

This project, therefore, encompasses only ODS consumption used in refrigerator and freezer manufacturing operations at MEPCO and the following tables provide a summary of refrigerator production during the 12 month period January to December 1994 inclusive.

Model No.	Capacity Lire	Descriptio n	Production Volume	R12 Change kgs	R12 Consump-tioKgs
NR-A852 FR	85	SD Ref	9,335	0.090	840.2
NR-A1401 FR	140	SD Ref	8,331	0.120	999.7
NR-A1401 E	140	SD Ref	17,847	0.115	2,052.4
NR-A1701 FR	170	SD Ref	9,258	0.120	1,111.0
NR-A1701 E	170	SD Ref	16,743	0.125	2.092.9
NR-A2001 FR	200	SD Ref	7,251	0.155	1.123.9
NR-A2001 E	200	SD Ref	9,933	0.150	1,490.0
NR-B1851 QD	185	SD Ref	3,336	0.165	550.4
NR-B2101 QD	210	SD Ref	4,563	0.165	753.0
NR-A2201 F	220	SD Frz	1,889	0.170	321.1
Totals or Weighted Average			88,486	0.128	11,335

Model No.	Cabinet & Door Liner Kgs (ABS)	PU Foam per Unit Kgs	R12 Compresor HP & Prices (US$)		R134a Compressor HP & Prices (US$)	
NR-A852 FR	2.503	2.30	0.08	26.37	0.09	29.01
NR-A1401 FR	3.217	3.30	0.08	26.37	0.11	29.87
NR-A1401 E	3.004	3.40	0.08	26.37	0.11	29.87
NR-1701 FR	3.537	3.85	0.11	27.15	0.19	30.59
NR-A1701 E	3.444	3.85	0.11	27.15	0.19	30.59
NR-A2001 FR	3.737	4.25	0.14	27.81	0.19	30.59
NR-A2001 E	3.644	4.25	0.14	27.81	0.14	30.59
NR-B1851 QD	3.451	4.60	0.20	31.07	0.25	34.18
NR-B2101 QD	3.691	5.35	0.25	31.65	0.28	34.82
NR-A2201 F	4.984	4.80	0.30	33.83	0.30	37.21
Totals or Weighted Average	3.337	3.75	27.49		30.71	

Key: SD = Single Door DD = Double Door Ref = Refrigerator
Frz = Freezer

4. PROJECT DESCRIPTION

Matsushita Electric Philippines Corporation (MEPCO) presently uses CFC 11 for the production of rigid insulating foams needed for the refrigerator and freezer cabinets and doors, and uses CFC 12 as refrigerant. The total consumption in the 12 months January - December 1994, and the ODP tons that will be eliminated by this project are shown in the following table:

Enterprise	CFC 11 (Tons)	ODP Tons eliminated (see notes)	CFC 12 (tons)	Total ODP tons eliminated
MEPCO	40.12	35.71	11.34	47.05

Notes: *The second column of figures for CFC 11 takes the ODP of HCFC 1 41b into account (ODP = 0.11).

The consumption data in the table does not include the CFC 12 u sed for re-charge after repairs and maintenance of refrigerators at MEPCO's service centres.

4.1. REPLACEMENT OF CFC 11 WITH HCFC 141b.

MEPCO has selected HCFC 141b to replace CFC 11 as an interim step to an ODS-free system. The reasons for the selection of HCFC 141b technology are provided in sections 3. and 5.1.2.

The enterprise currently has THREE Henneke high pressure PU foam dispensing machines, two of which are used for refrigerator cabinet foaming operations, the other one is used for refrigerator door foam insulation.

All three existing high pressure foam injection machines can be used to process the higher viscosities and mixing requirements of the HCFC 141b formulations, as well as most of the established, or developing, zero-ODP systems. Machine and equipment modifications would, however, be necessary to enable the existing equipment to safely handle a flammable blowing agent such as cyclo-pentane.

The conversion to HCFC 141b will incur some costs related to technology transfer, trialling and training at MEPCO. These activities will include training of staff in worker-safety related to HCFC 141b.

Details of the existing foam injection equipment are provided in section 5.1.3.

Incremental Operational Costs associated with the technology change from CFC 11 to HCFC 141b are requested for six months.

4.2. REPLACEMENT OF CFC 12 WITH HFC 134a.

HFC 134a is universally accepted as a zero-ODP replacement for CFC 12 in the manufacture of domestic refrigerators and the technology is mature. This is the CFC replacement technology selected by MEPCO.

The conversion to HFC 134a requires the use of HFC 134a specific compressors and the associated new synthetic lubricants, re-design of the refrigeration systems to cater for the difference in thermodynamic performance of HFC 134a versus CFC 12, prototyping, testing and optimization of each refrigerator model, and pilot scale manufacture and testing before full scale conversion of production to HFC 134a for each model. The conversion will result in changes in manufacturing procedures for which production line supervisor and operator training will be required.

The different properties of HFC 134a, the need to avoid cross-contamination with CFC 12, and the phased nature of the conversion of refrigerator production from CFC 12 to HFC 134a, means that new system evacuation, refrigerant charging, and leak detection equipment will be required.

Details of the existing equipment on which the technology change will impact are provided in section 5.2.3.

Incremental Operational Costs associated with the technology change from CFC 12 to HFC 134a are requested for six months.

5. TECHNOLOGY

5.1. REPLACEMENT OF CFC 11.

5.1.1. OVERVIEW

Currently, the three principal technology options for the replacement of CFC 11 in thermoset insulation foams are:

CFC 11 > partial water/HCFC 141b > ?
CFC 11 > partial water/HCFC 22,142b > HFC 134a, HFC 152a
CFC 11 > n-, iso-, or cyclo-, pentane

In addition, perfluoroalkanes, hydrofluoroalkanes such as HFCs 245, 356, etc., fluorinated ethers, 2-chloropropane, and vacuum panels have been suggested for specific applications, but the technologies are not mature. Furthermore, some of these products are either only available in limited quantities, or toxicological testing is not complete and, therefore, safety in use cannot be evaluated.

The first option, the "liquid" solution, employs technology that is closely related to the existing CFC 11 technology and generally means that existing foam dispensing equipment can be used. The final step to a zero-ODP technology in this process is not yet decided. One potential solution may be the use of liquid HFCs such as HFC 245 or HFC 356, but full water blown foam with improved cell structure remains another option.

The second one, <u>the "gas" solution</u>, utilizes physical blowing agents which are liquefied gases. This technology always requires new foam dispensing equipment and extensive adjustments. The final step to a zero-ODP technology in this process would be the use of a gaseous HFC such as HFC 134a.

The third option, <u>pentane technology</u>, is commercially proven and is now extensively used in many rigid PU insulation foam applications in Europe. It is currently the most cost effective of the non-ODS technologies for CFC replacement. However, pentanes are flammable and this means a careful review of manufacturing operations with respect to the safe handling of a flammable foam blowing agent. Pentane technology may not be a practical or cost effective option in the existing workplace environments at many smaller scale enterprises due to the plant safety modifications required.

Several companies currently offer pentane technology packages, including equipment, but its use also requires implementation assistance by a partner experienced in cyclo-pentane technology who must provide a signed agreement that it will provide assurances on safety issues to the enterprise. UNDP further requires an independent safety review prior to, and after, installation.

5.1.2. SELECTION

Based on economic and environmental considerations, cyclo-pentane appears to be the best choice for domestic refrigerator and freezer applications. It combines an attractive price with zero-ODP, and near-zero GWP properties. MEPCO considered cyclo-pentane technology, but whilst recognising both the environmental and economic benefits of cyclo-pentane versus HCFC 141b, they selected HCFC 141b as a first stage, interim, replacement for CFC 11.

Several important considerations influenced the MEPCO decision in favour of HCFC 141b technology:

- HCFC 141b is presently the technology selected by their Japanese partner MEI, from whom they will receive technical assistance with CFC 11 replacement.

- completed trials at MEPCO prove that HCFC 141b technology can be introduced quickly, utilising the existing equipment, with minimal investment cost and plant downtime.

- whilst cyclo-pentane technology could be introduced by the provision of the necessary safety equipment, cyclo-pentane storage and blending facilities, and retrofit of the existing foam dispensing machines, this would involve a major, and unacceptable, disruption of plant operations and loss of production. It could also not be accomplished within the corporate CFC elimination target date of end 1995.

- MEPCO plan to replace the HCFC 141b technology with cyclo-pentane, (or a commercially developed and acceptable alternative zero-ODP technology) when they move their refrigerator manufacturing operations to their other factory site at Laguna Technopark, Santa Rosa, in 1997. The choice will be dependent on the recommendations of MEI/MARCO, and their technical support. Cyclo-pentane technology is currently being tested by MARCO but is presently limited to a range of larger size refrigerators not produced by MEPCO.

- the purchase, installation, and commissioning of new cyclo-pentane based equipment in parallel to the existing equipment, in order to minimise production downtime, would be an attractive option if financed by the MLF. However, space constraints at the Taytay factory preclude this option.

The selection of HCFC 141b technology as the immediate replacement for CFC 11 by MEPCO is a realistic and sensible choice under the prevailing circumstances. Very modest funding is requested to achieve this and the technology choice is supported by the Philippines DENR. MEPCO understand that HCFC 141b is an interim solution which will require a change to an appropriate zero-ODP technology at some future date. MEPCO also understand and accept that the costs associated with that subsequent technology change is for their own account.

5.1.3. IMPACT ON THE PRODUCTION PROCESS

In-house trials have already demonstrated that HCFC 141b technology can be introduced utilising the existing high pressure foam dispensing equipment. Additional fine tuning trials and testing may be required when full scale production with HFC 141b is introduced.
HCFC 141b is moderately flammable in the gaseous state, but the liquid is not flammable. In the intended application, HCFC 141b/polyol blends should not pose any risk, but a monitoring check at commissioning will be performed to ensure safe worker exposure levels. Ventilation is to be installed where needed to ensure exposure levels are maintained below the recommended occupational exposure limit.

The refrigerator and freezer models produced by MEPCO use ABS cabinet and door liners. A modified ABS liner material which is resistant to HCFC 141b will be required.

Foam density adjustments will be necessary to obtain equivalent insulation values.

The existing foam dispensing equipment at MEPCO comprises:

- 1 x Henneke HK 650 high pressure PU foam dispensing machine, capacity 12.3 - 40 litres/ min.
- 1 x Henneke HK 430 high pressure PU foam dispensing machine, capacity 7.5 - 30 litres/min.
- 1 x Henneke HK 165 high pressure PU foam dispensing machine, capacity 4 - 16.5 litres/min

5.2. REPLACEMENT OF CFC 12.

5.2.1. OVERVIEW

HFC 134a is universally accepted as a replacement for CFC 12 in the manufacture of domestic refrigerators and freezers. HFC 134a is widely available and the technology is mature, having already been introduced commercially in many of the Developed Countries. Replacement of CFC 12 with HFC 134a requires relatively modest changes to existing production facilities.

Whilst hydrocarbon refrigerant (iso-butane) is being increasingly used in the manufacture of domestic refrigerators in several Developed Countries, the transfer of this technology to Developing Countries is not always cost effective. It also raises questions about safety issues and remains conditional on the support of a technology partner experienced in the production of comparable refrigerators and freezers on a commercial scale. It is further dependent on the technology partner providing assurances in writing on safety issues, and, of course, the availability of adequate supplies of both compressors and hydrocarbon refrigerant of the required quality.

HFC 152a might be considered as another candidate for CFC 12 replacement in domestic refrigerators. However, HFC 152a is also flammable, the technology has not been developed commercially, and there are some questions around it's stability in refrigerator systems. Furthermore, compressors for use with HFC 152a are not commercially available.

5.2.2. SELECTION

Based on the results of prototype testing and ongoing reliability studies, and the recommendation of Matsushita Refrigeration Company, Japan, the selected CFC 12 replacement technology is HFC 134a.

Additional technical assistance will be required in implementing the HFC 134a technology. This will be provided by Matsushita Refrigeration Company through the existing technology transfer agreement with MEI, and some provision for this is made within the project budget which will ensure successful project completion.

5.2.3. IMPACT ON THE PRODUCTION PROCESS

HFC 134a, like CFC 12, is non-flammable. HFC 134a has also been the subject of extensive toxicological testing and is considered safe in use in industrial applications provided the suppliers recommended occupational exposure levels are not exceeded. At the present time this means ensuring that exposure levels do not exceed 1000 parts per million on an 8-hour time-weighted average basis. This is the same as the Occupational Exposure Limit (OEL)/Threshold Limit Value (TLV) for CFC 12 and thus no changes from current practices are required.

There will be an approximately 10% reduction in the mass charge of HFC 134a compared with CFC 12 for a refrigerator system of the same capacity. This is taken into account in the calculation of the incremental operational costs.

It is well understood that the chemical stability of HFC 134a/synthetic lubricant systems in domestic refrigerators, and hence the long term performance of the appliance, is sensitive to moisture content and certain chlorinated impurities. This requires that CFC 12 and HFC 134a handling equipment be carefully segregated, and it also calls for better evacuation of the system prior to refrigerant charging.

Because system cleanliness and moisture content is paramount to the successful manufacture of HFC 134a refrigerators, MEPCO will need to carefully re-assess production procedures and re-train production personnel as appropriate. Provision for this is made within the project proposal budget.

The conversion from CFC 12 to HFC 134a will take place on a model by model basis, so that MEPCO will be producing both CFC 12 and HFC 134a refrigerators during the implementation phase of this project. This is feasible given the configuration of the company's production facilities. This means that there is a requirement for new system evacuation equipment and refrigerant charging equipment.

Leak detection of the refrigeration system is an integral part of the manufacturing process and the use of HFC 134a requires that new leak detection equipment be employed.

The relevant existing equipment at MEPCO on which the technology change to HFC 134a will impact is as follows:

- 1 x Nitto Oil Machinery Co. model RF-7V-12-1 automatic R12 charging machine. Complete with integral vacuum pump (9 M3/hr capacity) a nd R12 supply pump.

- 23 x Ulvac PVD-180 vacuum pumps, 10.8 M3/hr capacity.

- 13 x Shinko Seiki SVC-150 vacuum pumps, 9.5 M3/hr capacity.

- 2 x Toshiba HAL-8F programmable set point electronic R12 leak detectors for low and high pressure post charging leak testing.

The project proposal includes provision for ONE new R134a charging machine of equivalent capacity, FIVE replacement vacuum pumps, and TWO programmabl e set point R134a electronic leak detectors.

Provision is made for retrofit of the remaining vacuum pumps where considered feasible, or the funding provided for retrofitting will be used by MEPCO towards the purchase of new vacuum pumps, at their own discretion.

MEPCO have already ordered (February 1995) a new replacement automatic R134a charging machine, model RF-8V-CE from Toyo Oil Machinery Co. Ltd., Japan, at a price of US$ 141,396.80 FOB Japan. This is scheduled for delivery in mid-May 1995, in time for pilot scale production of 500 R134a based refrigerators planned for June 1995.

This refrigerant charging machine is of a similar specification and capacity to the existing R12 equipment. Retroactive funding for this item is requested, in accordance with normal UN procedures. The proposed project budget for this item reflects the international market price for equivalent R134a charging equipment, not the purchase price of the equipment ordered by MEPCO.

Note that the project proposal does not include the costs of the new purpose-built environment test chambers purchased and installed by MEPCO for R134a refrigerator development.

6. PROJECT COSTS

6.1. INCREMENTAL CAPITAL COSTS

CAPITAL COST FOR CFC 11 PHASE-OUT

TRAINING, TEST TRIALS & TECHNOLOGY TRANSFER	20,000
Subtotal (US$)	**20,000**

CAPITAL COST FOR CFC 12 PHASE-OUT

REFRIGERANT CHARGING EQUIPMENT (1 off)	55,000
NEW VACUUM PUMPS (5 off)	20,000
RETROFITTING VACUUM PUMPS (31 off)	15,500
R134a LEAK DETECTION EQUIPMENT (2 off)	15,000
TRAINING	10,000
RE-DESIGN, PROTOTYPING, TESTING, PILOT SCALE PRODUCTION & RELIABILITY TEST TRIALS	35,000
TECHNOLOGY TRANSFER/TECHNICAL ASSISTANCE	15,000
CONTINGENCIES (10%)	16,500
Subtotal (US$)	**182,000**

TOTAL INCREMENTAL CAPITAL COST (US$)	**202,000**

6.2 INCREMENTAL OPERATING COSTS & BENEFITS

The calculation of the incremental operating costs is based on a six month period using 50% of the actual production for January to December 1994 inclusive and ignoring growth. Annex A. provides detailed explanations on how the incremental operational costs were obtained, the costs are summarized below:

PHASE-OUT OF CFC 11

Cost for Materials (see Annex A Part 1.):	**195,775**

PHASE-OUT OF CFC 12

Costs for Materials (see Annex A Part 2.):	**176,647**
TOTAL INCREMENTAL OPERATING COST (US$)	**372,422**

6.3. TOTAL PROJECT INCREMENTAL COSTS

TOTAL COST (Capital + Operational) (US$)	**574,422**
% Article 5.1 Country Ownership	**20%**
FUNDING REQUESTED FROM MLF (US$)	**114,884**

6.4 UNIT ABATEMENT COST (US$/Kg)

a. Capital Investment Costs (20% of US$ 202,000)	**40,400**
b. Capital Recovery Factor (10% p.a.)	**0.16275**
c. Incremental Operating Costs (20% of US$ 372,422)	**74,484**
d. ODS Reduction (ODP Kgs Jan - Dec 94)	**47,050**
e. Unit Abatement Cost (US$/Kg) [(a x b) + c] /d	**1.72**

THE PROJECT UNIT ABATEMENT COST IS 1.72 US$/Kg

6.5 COST EFFECTIVENESS (US$/Kg)

TOTAL PROJECT COST	=	**574,422**	**US$**
TOTAL ODS CONSUMPTION	=	**51,460**	**ODP Kgs**
PROJECT COST EFFECTIVENESS	=	**11.16**	**US$/Kg**

THE PROJECT COST EFFECTIVENESS IS 11.16 US$/Kg

7. FINANCING PLAN

Matsushita Electric Philippines Corporation (MEPCO) requests reimbursement of US$ 114,884 representing 20% of the project costs in line with the Article 5.1 country ownership of the enterprise.

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the successful implementation of this project, and will provide technical assistance during project execution.

8.2 SCHEDULE

TASK	TIME TO COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	X					
Procurement Preparation	XX	X				
Vendor Selection		XX				
2. Installation						
Arrival of Equipment		XX				
Customs Clearance		X				
Machine Installation		X	X			
3. Start-Up						
Machine Start-up			X			
Trials & Training			XXX	XXX	XX	
Mass Production Change					X	XX
Certification						X

9. PROJECT IMPACT

This project will eliminate the use of 47.05 ODP tons per year. This is based on figures for the 12 months, January - December 1994.

10. ANNEXES

Annex A: Incremental Operational Cost Calculations.
Annex B: Project Technical Reviews.
Annex C: Description of Technology Agreement between MEPCO and Matsushita Refrigeration Company, Japan.
Annex D: MEPCO letter regarding HCFC 141b technology selection.

ANNEX A. INCREMENTAL OPERATIONAL COST CALCULATIONS

1. Incremental Costs resulting from replacing the CFC 11 Blowing Agent in the Refrigerator Insulation Foam with HCFC 141b (US$)

MATSUSHITA ELECTRIC PHILIPPINES CORPORATION	CFC 11	HCFC 141b	Diff
Use per Kg of Foam produced			
a. Kg Polyol	0.414	0.419	0.005
b. TDI/MDI	0.465	0.471	0.006
c. Kg Blowing Agent	0.121	0.110	(0.011)
Prices in US$/Kg			
d. Polyol	2.444	2.566	0.122
e. TDI/MDI	2.060	2.060	-
f. Blowing Agent	2.350	4.000	1.650
g. Liner (Type: ABS)	2.002	2.789	0.787
Cost per Kg of Foam Produced			
h. = a. x d. Polyol	1.012	1.075	0.063
i. = b. x e. MDI	0.958	0.970	0.012
j. = c. x f. Blowing Agent	0.284	0.440	0.156
k. = h+i+j Total Cost per Kg of Foam	2.254	2.485	0.231
Materials Used per Refrigerator			
l. Kg of Foam per Refrigerator (avg)	3.750	4.125	0.375
m. Kg of Liner material per refrigerator (avg)	3.337	3.337	-
Cost per Refrigerator			
n. = l. x k. for Foam	8.452	10.251	1.799
o. = m. x g. for Liner	6.681	9.307	2.626
p. = n. + o. Total per Refrigerator	15.133	19.558	4.425
q. = No. of Refrigerators (see Note 1.)	44,243		
TOTAL INCREMENTAL OPERATIONAL COST (US$)	**195,775**		

(see Notes 1., and 2. below)

ANNEX A (contd)

2. Incremental Costs resulting from replacing the CFC 12 Refrigerant with HFC 134a (US$)

MATSUSHITA ELECTRIC PHILIPPINES CORPORATION	CFC 12	HFC 134a	Diff
1. Refrigerant			
a. Price per Kg of Refrigerant	2.87	8.00	
b. Kg of Refrigerant per Refrigerator (avg.)	0.128	0.115	
c. No. of Refrigerators Produced (see Note 1.)	44,243	44,243	
1d. Cost for Refrigerant = a x b x c	16,253	40,704	24,451
2. Compressors			
a. Cost per Compressor (see Note 2.)	27.49	30.71	
b. No. of Compressors (see Note 1.)	44,243	44,243	
2c. Cost for Compressors = a x b	1,216,240	1,358,703	142,463
3. Condensers			
a. Cost per Condenser	n/c	n/c	
b. No. of Condensers	44,243	44,243	
3c. Cost for Condensers = a x b	-	-	-
4. Filter/Dryer			
a. Cost per Filter/Dryer (average)	0.480	0.600	
b. No. of Filter/Dryers (see Note 1.)	44,243	44,243	
4c. Cost for Filter/Dryers = a x b	21,237	26,546	5,309
5. Capillary Tubes			
a. Cost per Capillary Tube (average)	0.396	0.496	
b. No. of Capillary Tubes (see Note 1.)	44,243	44,243	
5c. Cost for Capillary Tubes = a x b	17,520	21,944	4,424
TOTAL INCREMENTAL OPERATIONAL COST (US$) = 1d + 2c + 3c + 4c + 5c (Diff)		**176,647**	

Note 1. Figures in the above tables are based on the actual production volume for the 12 month period, January to December 1994, obtained from Matsushita Electric Philippines Corporation (MEPCO) at the time of project preparation. As Incremental Operational Costs are claimed for 6 months only, 50% of this 12 months production volume has been used in the calculation.

Note 2. Compressor, component, and chemical prices used in the above tables are best estimates of Philippines National prices.

Note 3. The calculated incremental cost for the HFC 134a refrigerant is based on a 10% reduction in the mass charge compared with CFC 12.

TECHNICAL REVIEW BY:

MARTIEN JANSSEN

Country of origin: PHILIPPINES
Project title: Elimination of CFCs 11 and 12 in the Manufacture of Domestic Refrigerators at MATSUSHITA ELECTRIC PHILIPPINES CORPORATION (MEPCO)

Sector/sub-sector Domestic refrigeration
Relationship to country program UNDP
Note *This review addresses only the refrigerant conversion part of the project, it does not address the part related to the foam blowing agent conversion.*

Technology
- MEPCO has chosen for a conversion of their production to the HFC-134a technology.
- In domestic refrigeration, HFC-134a technology is a proven and acceptable (nontransitional) technology to reduce CFC-12 consumption.
- MEPCO does have an ongoing technology transfer agreement with the parent company MATSUSHITA, Japan which covers also transfer of know-how related to the HFC-134a technology. Moreover, MEPCO uses the brand names of the parent company and has to meet the Japanese quality standards. Due to this cooperation a successful project implementation can be expected.
- Other technologies than HFC-134a were considered (hydrocarbons, HFC-152a) but were not selected because of the state of development, safety issues and the lack of commercially available compressors. From the zero ODP technologies HFC-134a is one of the most cost effective solutions.

Environmental impact
HFC-134a has an ODP of zero and a GWP of 1300. For domestic refrigeration a GWP of this magnitude is negligible.

Project costs
- The equipment requested by MEPCO is essential for the conversion process and costs are reasonable.
- Part of the conversion costs have already been made by the company, i.e. retroactive financing is requested.
- Some capital investment costs are incurred by the company (e.g. test room, part of the costs of the refrigerant charger)
- Costs of equipment, training, testing and technology transfer are reasonable.
- The incremental operational costs claimed are reasonable and correctly applied (for a six months period).
- If the UAC value is calculated for the refrigerant conversion part of the project separately, then a value of 3.75 USD/kg/year which is very low, compared to similar projects. The reason for this is the low local ownership of the company (20 %)
- The foreign ownership of the MEPCO company is correctly taken into account.

Implementation timeframe Reasonable.
Relevance and adequacy of information provided Reasonable.
Recommendations Approval as proposed

Janssen M.J.P.,
Eindhoven, The Netherlands
11-May-1995

Kuijpers L.J.M.,
University Eindhoven, The Netherlands

ANNEX B
1

TECHNICAL REVIEW. BY:Hubert Creyf

already sent

1.Country:

Philippines.

2.Project Title:

Elimination of CFCs 11 and 12 in the Manufacture of Domestic Refrigeration at MATSUSHITA ELECTRIC PHILIPPINES CORPORATION (MEPCO).

3.(Sub)Sector:

Domestic Refrigeration.
This review covers only the foam part.

4.CP-Relationship:

The Philippines CP for the phase-out of ODS was approved at the 10th Meeting of the Executive Committee of the MLF in 1993.The World Bank is the Implementing Agency.The Natonal Coordinating Body is the Energy Management Bureau, Department of Environmental and National Sources.

5.Technology:

MEPCO wants to replace 40.12 T/a of CFC 11, now used as blowing agent in the insulating polyurethane foam in refrigeration cabinets and doors.
The choice to HCFC 141b is acceptable in the case of MEPCO because:
- the Japanese parent compagnies provide know-how for the technology transfer,
- enironmental and economic arguments given are correct
- a change-over to 100% ODS free technology will take place in 1997 after a planned move to a factory site where the necessary safety provisions will be built in.

Reference can also be made to the 1994 " Report of the Flexible and Rigid Foams Technical Options Committee" (EPA 430/K94/028) in which conversion to HCFC technology is estimated to be over 95% in the USA(p.III-3).

6.Environmental Impact:

The ODP of HCFC 141b is 0.11; the ODP of CFC 11 being 1.0. The GWP of HCFC 141b is 10% of the GWP of CFC 11.

7.Project Costs:

The incremental capital costs for the change to HCFC 141b only makes reference of training costs, since all necessary equipment is apt to use as well CFC 11 as HCFC 141b.
The incremental operation costs are acceptable as presented.
The total costs for substitution of CFC 11 by HCFC 141b are hence USD(20,000 +195,775) or USD 215,775.The project costs become then USD 43,159.

This means that elimination of 1 kg of ODS costs USD(35,710/43,159) or USD 0.82.

8.Implementation:

For the foam part a shorter implementation period than 1.5 year can be envisaged.

9.Recommendation:

It is recommended to accept the project as presented considering the low ODS elimination cost to the MLF.

Prepared by Hubert Creyf, UNDP Foam Sector Reviewer.
Date:052895.

National/Panasonic
Matsushita Electric Philippines Corporation (MEPCO)
o Manufacturing Division: Ortigas Avenue Ext., Taytay, Rizal
o Sales & Mktg. Division : Bonaventure Plaza Bldg., Ortigas Ave., Greenhills
San Juan, Metro Manila, Philippines

TECHNICAL ASSISTANCE AGREEMENT

MATSUSHITA ELECTRIC PHILIPPINES CORPORATION (MEPCO) has a Technical Assistance Agreement with *MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD (MEI)* of Japan which provides, among others that :

Technical Assistance

Tecnical Information

MEI will furnish *MEPCO* with a set of technical data and information embodying new technology and/or improvements on the existing technical knowhow and production technique relating to the products mentioned in Article 1 of the Agreement (which includes refrigerators and freezers) .

Whenever a new product (i.e. specific models or types of the products) is selected during the term of the Agreement, *MEI* will furnish *MEPCO* with written technical information specific to the new product.

Technical Service

MEI, at the request of *MEPCO* and by consent of *MEI*, will receive *MEPCO* engineers at *MEI* factory in Japan for purposes of getting technical advice and training.

MEI, at the request of *MEPCO* and by consent of *MEI*, will send its engineers to *MEPCO* to provide advisory and technical service.

All costs and expenses incurred in the aforementioned technical services shall be borne by *MEPCO*.

Technical Assistance rendered by *MEI* to *MEPCO* shall include supply of assistance, information and advice related to the designing of products.

Domestic
P.O. Box 115
Makati Commercial Center
Makati, Metro Manila

Foreign
P.O. Box 7753
NAIA Airmail Exchange Div.
Pasay, Metro Manila, Philippines

Telephone
Manufacturing Division: 665-0663 to 65
665-0668/70
665-0621/22

Telex
Manufacturing Division: MEPCO PH 22300
Sales & Mktg. Div. MEPCO PH 29030

Remuneration

In consideration of the license and the technical assistance provided by *MEI*, *MEPCO* agrees to pay technical assistance fee equivalent to 3% of net sales.

Maintenance of Quality and Safety

MEPCO agrees to comply with all specifications and quality standards set by *MEI* in manufacturing the products.

Trademark

MEPCO shall use the trademarks owned and designated by *MEI* provided that such products shall meet and maintain the quality standards and/ or specifications set by *MEI*.

General Provision

Performance of Technical Assistance

MEI may cause *MEI*'s subsidiaries or affiliates to render to *MEPCO* any of the technical assistance provided for in the agreement for and on behalf of *MEI*.

Change of Specifications

MEPCO shall not make any change of specifications in the products without prior written approval of *MEI*.