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EXECUTIVE COMMITTEE
OF THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Twenty-seventh Meeting
Montreal, 24-26 March 1999

PROJECT PROPOSALS: INDIA

This document consists of the comments and recommendations of the Fund Secretariat on the following projects:

Foam

• Conversion from CFC-11 to HCFC-131b technology in the manufacture of rigid polyurethane foam insulation products at Baba Insulator	UNDP
• Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Bansal Plastic Industries	UNDP
• Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Ganga Thermoware	UNDP
• Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insitu and spray insulation at P.K. Construction Co.	UNDP
• Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation at R.S. Insulators	UNDP
• Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Shree Nath Plastics	UNDP

Refrigeration

• Elimination of CFCs in the manufacture of domestic refrigerators at Whirlpool of India Ltd.	World Bank

PROJECT EVALUATION SHEET
INDIA

SECTOR: FOAM ODS use in sector (1991): 1,577 ODP tonnes
Sub-sector cost-effectiveness thresholds: Rigid US $7.83/kg

Project Titles:
(a) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation products at Baba Insulator.
(b) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Bansal Plastic Industries.
(c) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Ganga Thermowares P. Ltd.
(d) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam in situ and spray insulation at P. K. Construction Co.
(e) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation at R. S. Insulators.
(f) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Shree Nath Plastics.

Project Data	**Rigid**					
	Baba Insulator	Bansal Plastic	Ganga Thermoware	P. K. Construction	R. S. Insulators	Shree Nath
ODS (CFC-11) phase out (ODP tonnes)	15.60	22.10	10.90	11.50	11.20	15.10
Proposed project duration (months)	24	24	24	30	24	24
Incremental capital cost (US$)	44,000	49,500	71,500	33,000	44,000	49,500
- including contingency (%)	10	10	10	10	10	10
Incremental operational cost (US$)	15,096	22,079	28,687	41,172	10,840	14,620
Total project cost (US$)	59,096	71,579	100,187	74,172	54,840	64,120
Local ownership (%)	100	100	100	100	100	100
Export component (%)	0	0	0	0	0	0
Amount requested (US$) {Original}	70,083	108,214	78,739	74,172	62,606	108,657
{Revised}	59,096	71,579	78,864	74,172	54,840	64,120
Cost effectiveness (US$/kg.)	4.10	3.51	7.83	6.98	5.30	4.40
National Coordinating Agency	Ministry of Environment and Forests					
Implementing Agency	UNDP					
Technical review completed?	Yes					
Secretariat s Recommendations						
Amount recommended (US $)	59,096	68,829	78,864	74,172	54,800	61,370
Project Impact (ODP tonnes)	14.41	20.42	10.06	10.62	10.33	13.95
Cost effectiveness (US $/kg)	4.11	3.37	7.83	6.98	5.30	4.40
Implementing Agency support cost (US$)	7,682	8,948	10,252	9,642	7,124	7,978
Total cost to Multilateral Fund	66,778	77,777	89,116	83,814	61,924	69,348

PROJECT DESCRIPTION

(a) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation products at Baba Insulator.
(b) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Bansal Plastic Industries.
(c) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Ganga Thermowares P. Ltd.
(d) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam in situ and spray insulation at P. K. Construction Co.
(e) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation at R. S. Insulators.
(f) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Shree Nath Plastics.

Sector Information

1. Baseline consumption (average 1995-1997) of Annex A Group I substances (CFCs) reported to the Ozone Secretariat: 6,881 ODP tonnes.
Baseline consumption of Annex A Group I substances for the foam sector: Not available.

2. The inventory of approved projects shows that as of November 1998 US $16.7 million had been approved for projects in the foam sector to phase out 2,099.8 ODP tonnes of Annex A Group I substances (CFCs). US $6.17 million had been disbursed and 545.1 ODP tonnes CFCs phased out.

3. The consumption of CFCs used by UNDP in the sector background information is based on 1991 which is out of date. Therefore, it would not be possible to assess the impact of the sector on the phase out of Annex A Group I substances. Analysis made in the sector background information to determine the amount of CFC needed to be covered by the Multilateral Fund projects to enable India to meet its freeze requirements was based on the assumption of 20% CFC consumption growth rate which is not representative of the real situation. Annex A Group I substances consumption data reported by India to the Ozone Secretariat for 1996 and 1997 were 6,937.4 ODP tonnes and 6,703.3 ODP tonnes, showing a reduction in 1997 of about 3% of the 1996 consumption.

4. Based on the assumption of 20% consumption growth rate, it was estimated that 1999 consumption would be 11,987 tonnes and the baseline consumption of annex A Group I substances 7,221. The actual baseline consumption of 6,881 was about 5% less than forecast. Similarly, the 1999 consumption could be much less than forecast, given what appears to be a decreasing rather than increasing trend in the CFC consumption. In view of this the conclusion in the project document that 433 ODP tonnes will be required in project approvals in order for India to meet its 1999 freeze obligations may require re-examination.

Impact of the Projects on the Country's Montreal Protocol Obligations

5. The document states as follows:

> "The approval of these projects will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules including the 1999 freeze".

6. The extent of reduction in the foam sector consumption and its eventual impact on the country's consumption of Annex A Group I substances cannot be ascertained since the project data analysis is based on 1991 which is no longer relevant. Based on India's baseline consumption of 6,881 ODP tonnes, the total CFC to be phased out from the six projects of 79.7 tonnes (average 13.3 tonnes) will result in a reduction of the baseline consumption of about 1.2%. The residual ODP resulting from the use of HCFC-141b is 6.6 ODP tonnes.

Justification for the use of HCFC-141b

7. All six projects will phase out CFC-11 through the use of HCFC-141b. Detailed justification provided by UNDP has been attached to this evaluation as Appendix I. UNDP also provided for each project a "projected techno-economic impact of zero-ODP technologies" and a statement on "estimated cost of future conversion to zero-ODP technology". Sample of these (for Ganga Termoware CFC consumption: 10.9 ODP tonnes) is attached as Appendix II.

(a) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation products at Baba Insulator.

8. The project will phase out 15.60 tonnes of CFC-11 annually. Baba Insulator produces rigid polyurethane foam products such a slabs, boards, panels, pipe sections etc, by converting to HCFC-141b as blowing agent. Currently the polyurethane chemicals are manually poured and mixed by stirring in open containers and the smaller quantities poured into moulds or cavities to be foamed. Since the enterprise procures premixed systems the project considers CFC evaporation losses to be negligible.

9. Savings amounting to US $30,555 due to more efficient handling of chemicals estimated to be 10% of post-conversion chemical costs have been deducted from the project costs. The project includes incremental capital costs covering partial costs for introduction of a high pressure foam dispenser (i.e US $40,000 with enterprise contribution of US $20,000), trials (US $5,000), technical assistance (US $10,000) and training (US $5,000) and incremental operating costs (US $26,083) resulting from conversion to the new technology.

(b) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Bansal Plastic Industries.

10. This project will phase out 22.10 tonnes of CFC-11 consumption annually, in the production of rigid polyurethane foam insulated thermoware at Bansal Plastic Industries, by converting to HCFC-141b as blowing agent. Bansal currently uses similar techniques as Baba Insulator to produce its foam. The project will include incremental capital costs covering partial

costs for introduction of a medium pressure foam dispenser (US $45,000 with enterprise contribution of US $20,000), trials (US $5,000), technical assistance (US $10,000) and training (US $5,000) and incremental operating costs (US $36,714) resulting from conversion to the new technology.

11. An amount of US $43,270 based on 10% of the systems cost after conversion is deducted from the project costs as savings for efficient handling of chemicals following conversion.

(c) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Ganga Thermowares P. Ltd.

12. This project will phase out 10.90 tonnes of CFC-11 consumption annually in the production of rigid polyurethane foam insulated thermoware at Ganga Thermowares P. Ltd., by converting to HCFC-141b as blowing agent. The project will include incremental capital costs covering the replacement of the existing foam dispenser (US $45,000), trials (US $5,000), technical assistance (US $10,000) and training (US $5,000) and incremental operating costs (US $36,660) resulting from conversion to the new technology.

(d) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam in situ and spray insulation at P. K. Construction Co.

13. This project will phase out 11.50 tonnes of CFC-11 consumption annually in the production of rigid polyurethane foam in situ and spray insulation at R.S. Insulators, by converting to HCFC-141b as blowing agent. The project will include incremental capital costs covering the retrofitting of the existing foam dispenser (US $10,000), trials (US $5,000), technical assistance (US $10,000) and training (US $5,000) and incremental operating costs (US $41,172) resulting from conversion to the new technology.

(e) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation at R. S. Insulators.

14. This project will phase out 22.10 tonnes of CFC-11 consumption annually in the production of rigid polyurethane foam in situ foam insulation at R. S. Insulators, by converting to HCFC-141b as blowing agent. The project will include incremental capital costs covering the partial costs of introduction of a high pressure foam dispenser at US $20,000 as in the case of Baba Insulators, trials (US $5,000), technical assistance (US $10,000) and training (US $5,000) and incremental operating costs (US $18,606) resulting from conversion to the new technology.

(f) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Shree Nath Plastics.

15. This project will phase out 15.10 tonnes of CFC-11 consumption annually in the production of rigid polyurethane foam insulated thermoware at Shree Nath Plastics, by converting to HCFC-141b as blowing agent. The project will include incremental capital costs covering the introduction of a medium pressure foam dispenser for US $45,000 with enterprise contribution of US $20,000, trials (US $5,000), technical assistance (US $10,000) and training

(US $5,000) and eligible incremental operating costs (US $46,127) resulting from conversion to the new technology.

16. Both R. S. Insulator and Shree Nath Plastics also currently have similar production operations as Baba Insulators. Again as with Baba Insulator the amounts of US $21,927 and US $30,918 respectively have been deducted from their project costs as savings due to more efficient handling of chemicals after conversion.

Equipment to be destroyed or rendered unusable

17. Ganga Thermowares will have one low pressure machine destroyed after project implementation but the rest of the companies do not have any equipment to be destroyed.

SECRETARIAT S COMMENTS AND RECOMMENDATIONS

COMMENTS

1. In all the projects where there are no machines in the baseline, an agreed percentage of the price of the machine to be installed, namely 50% for the high pressure machines and 33% for "medium" pressure machines have been deducted from the capital costs as the enterprises' contribution.

2. Where there are losses of CFC-11 and other chemicals UNDP has accounted for these losses by deducting an amount equivalent to 10% of the post-project systems cost from the incremental operational cost (as savings due to efficient handling of chemicals after conversion).

3. All the project costs have been agreed between UNDP and the Secretariat.

4. The sector background information provided in the project documents by UNDP is out of date and may also be inaccurate. Information based on more accurate and recent data would be more relevant in demonstrating the significance of foam sector projects on the country's ODS phase out.

RECOMMENDATIONS

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

Project Title	Project Cost US $	Support Cost US $	Implementing Agency
Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation products at Baba Insulator	59,096	7,682	UNDP
Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Bansal Plastic Industries.	68,829	8,948	UNDP
Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Ganga Thermowares P. Ltd.	78,864	10,252	UNDP
Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam in situ and spray insulation at P. K. Construction Co.	74,172	9,642	UNDP
Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation at R. S. Insulators.	54,800	7,124	UNDP
Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Shree Nath Plastics.	61,370	7,978	UNDP

2. The Executive Committee may wish to request the implementing agencies when preparing projects for the country to provide data in the sector background information that are accurate and relevant and demonstrate the relationship of the ODS phased out in projects in the sector with the country's overall ODS phase out programme or its obligations under the Montreal Protocol.

Appendix I

Justification for the use of HCFC technology

(a) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation products at Baba Insulator.

1. This project will phase out 15.60 tonnes of CFC-11 annually, in the production of rigid polyurethane foam insulation products at Baba Insulator, by converting to HCFC-141b as blowing agent. The project will include incremental capital costs covering partial costs for introduction of a high pressure foam dispenser (US $20,000), trials (US $5,000), technical assistance (US $10,000) and training (US $5,000) and eligible incremental operating costs (US $26,083) resulting from conversion to the new technology.

2. HCFC-141b has a boiling point near ambient temperatures. HCFC-141b based systems are technically mature and commercially available. They also provide relatively the most acceptable insulation value and energy efficiency, and the lowest investment and operating costs vis-a-vis other options. No major changes in the auxiliary equipment/tooling in the production program, such as jig/mould redesign, are needed. However, HCFC-141b has residual OPD and is also and aggressive solvent.

3. Pentane based systems require extensive safety related provisions/investments due to their flammability. Due to safety considerations, the use of pre-blended systems is not viable and additional investments for in-house pre-mixing are required. Cyclopentane has miscibility limitations with polyols. The moulded densities and insulation values are still inferior to those obtained with HCFC-141b. The advantages are their relatively lower operating costs, they are environmentally relatively safe (no ODP/GWP or health hazards) and constitute a permanent technology. Hydrocarbons are therefore the preferred conversion technology for large and organized users, where the safety requirements can be complied with and investments can be economically justified.

4. Gaseous HFCs have been used successfully but have not been applied widely due to cost and availability factors.

5. The enterprise will convert to CFC-free systems in future, for their rigid polyurethane foam operations. Until the commercial introduction of mature CFC-free systems (which is expected in up to 3-4 years at the earliest) HCFC-141 based systems will need to be used as an interim technology, to maintain product standards and acceptability.

6. The implementing agency expert appraised the prospective recipient enterprise, Baba Insulator, prior to the preparation of this project document, during August 1998 and had detailed discussions with the technical and managerial personnel of the enterprise, regarding the choice of technology for replacing the existing CFC-based technology, under the project. The enterprise was briefed in detail about the following:

(a) An overview of the available interim (low ODP) and permanent (zero ODP) replacement technologies.

(b) the impact of each technology on the products manufactured, and the processes and practices employed by Baba Insulator.

(c) The possible implication of each technology, in terms of its known impact on environment, health and safety, such as ozone depleting potential, global warming potential, occupational health, fire and explosion hazards.

(d) It was emphasized to Baba Insulator, that HCFC technologies are interim in nature due to their residual ODP and therefore may continue to adversely affect the environment, though at a lower scale that CFCs.

(e) It was further explained that HCFCs may become controlled substances under present or future international conventions and will therefore also need to be phased out at a future date, and any investments required for their phase out and for conversion to safer technologies, may have to be borne by Baba Insulator.

7. Baba Insulator indicated their preference for selection HCFC-141b based technology, in their manufacture of rigid polyurethane foam insulation products and offered the following justifications:

(a) The only feasible zero-ODP technology options are hydrocarbons (pentanes) and water-based systems. The storage and handling of hydrocarbons requires compliance with extensive and stringent local safety regulations, in view of the flammability of hydrocarbons and the fire, explosion and security hazard they presents. In the present premises of Baba Insulator, located in a densely populated industrial area, such compliance is not possible. It would not be cost-effective or viable to Baba Insulator to relocate their manufacturing facilities to ensure such a compliance. Water-based systems do not meet the critical product technical requirements on density and thermal conductivity and applying this technology will make their products un-competitive. This might lead to unviable operations and even closure of the plant.

(b) Since hydrocarbons cannot be pre-mixed in polyols due to the safety hazard they present in transportation, additional investments on in-house premixing equipment will be required. Considering the volume of production at Baba Insulator, such investments are not economically viable.

(b) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Bansal Plastic Industries.

8. The implementing agency expert appraised the prospective recipient enterprise, Bansal Plastic Industries, prior to the preparation of this project document, during August 1998 and had detailed discussions with the technical and managerial personnel of the enterprise, regarding the

choice of technology for replacing the existing CFC-based technology, under the project. The enterprise was briefed in detail about the following:

(a) An overview of the available interim (low ODP) and permanent (zero ODP) replacement technologies.

(b) The impact of each technology on the products manufactured, and the processes and practices employed by Bansal Plastic Industries.

(c) The possible implication of each technology, in terms of its known impact on environment, health and safety, such as ozone depleting potential, global warming potential, occupational health, fire and explosion hazards.

(d) It was emphasized to Bansal Plastic Industries, that HCFC technologies are interim in nature due to their residual ODP and therefore may continue to adversely affect the environment, though at a lower scale that CFCs.

(e) It was further explained that HCFCs may become controlled substances under present or future international conventions and will therefore also need to be phased out at a future date, and any investments required for their phase out and for conversion to safer technologies, may have to be borne by Baba Insulator.

9. Bansal Plastic Industries indicated their preference for selection HCFC-141b based technology, in their manufacture of rigid polyurethane foam insulation products and offered the following justifications:

(a) Hydrocarbons (pentanes) technology involves fire and explosion hazards. The local laws governing the use of hydrocarbons cannot be complied with, in the existing manufacturing premises of Bansal Plastic Industries, as they are located in a crowded industrial area. Due to the sharp competition in the thermoware market, investments on changing or relocating the factory are not commercially justified at this point.

(b) Thermoware production in India is labour intensive. Therefore are a large number or workers in the factory at any given time. Hydrocarbon technology will cause a safety and security risk, due to the fire and explosion hazard.

(c) The local polyol producers offer stable HCFC-141b based formulations, which are being successfully used by their competitors who have earlier participated in the Montreal Protocol programme. They also doubt that pentanes of the necessary grades are easily or economically available for the relatively small quantities they consume.

(d) Bansal Plastic Industries also feel, that the additional equipment required for using pentane-based technology will present a long term operation and maintenance challenge, in terms of additional costs and trained labour. They

would rather opt for simple and rugged equipment, which is adequate for HCFC based systems.

(e) Bansal Plastic Industries believe that HCFCs are environmentally much safer than CFCs. The changeover is cost-effective and quick as compared to other options. The technology is proven in the Indian market. Thus, they would prefer HCFC technology.

(c) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Ganga Thermowares P. Ltd.

10. The implementing agency expert appraised the prospective recipient enterprise, Ganga Thermowares P. Ltd., prior to the preparation of this project document, during August 1998 and had detailed discussions with the technical and managerial personnel of the enterprise, regarding the choice of technology for replacing the existing CFC-based technology, under the project. The enterprise was briefed in detail about the following:

(a) An overview of the available interim (low ODP) and permanent (zero ODP) replacement technologies.

(b) The techno-economic impact of each technology on the products manufactured, and the processes and practices employed by Ganga Thermowares P. Ltd..

(c) The possible implication of each technology, in terms of its known impact on environment, health and safety, such as ozone depleting potential, global warming potential, occupational health, fire and explosion hazards.

(d) It was emphasized to Ganga Thermowares P. Ltd. that HCFC technologies are interim in nature due to their residual ODP and therefore may continue to adversely affect the environment, though at a lower scale that CFCs.

(e) It was further explained that HCFCs may become controlled substances under present or future international conventions and will therefore also need to be phased out at a future date, and any investments required for their phase out and for conversion to safer technologies, may have to be borne Ganga Thermowares P. Ltd..

11. Ganga Thermowares P. Ltd. indicated their preference for selection of HCFC-141b based technology, in their manufacture of rigid polyurethane foam insulated thermoware. The justifications offered by them are summarized below:

(a) Hydrocarbons (pentanes) technology involves fire and explosion hazards. The local laws governing the use of hydrocarbons cannot be complied with, in the existing manufacturing premises of Ganga Thermowares P. Ltd., as they are located in a crowded industrial area. Due to the sharp competition in the thermoware market, investments on changing or relocating the factory are not commercially justified at this point.

(b) Thermoware production in India is labour intensive. Therefore, there are a large number of workers in the factory at any given time. Hydrocarbon technology will cause a safety and security risk, due to the fire and explosion hazard.

(c) The local polyol producers offer stable HCFC-141b based formulations which are being successfully used by their competitors who have earlier participated in the Montreal Protocol programme. They also doubt that pentanes of the necessary grades are easily or economically available for the relatively small quantities they consume.

(d) Ganga Thermowares P. Ltd. also feels that the additional equipment required for using pentane-based technology would present a long-term operation and maintenance challenge in terms of additional costs and trained labour. They would rather opt for simple and rugged equipment, which is adequate for HCFC-based systems and for phasing out most of the CFCs.

12. Ganga Thermowares P. Ltd. believe that HCFCs are significantly safer than CFCs for the environment and the changeover is quick and cost-effective as compared to other options. They would therefore prefer HCFC technology after considering all the merits and demerits of other options.

(d) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam in situ and spray insulation at P. K. Construction Co.

13. The implementing agency expert appraised the prospective recipient enterprise, P.K. Construction Co., prior to the preparation of this project document, during August 1998 and had detailed discussions with the technical and managerial personnel of the enterprise, regarding the choice of technology for replacing the existing CFC-based technology, under the project. The enterprise was briefed in detail about the following:

(a) An overview of the available interim (low ODP) and permanent (zero ODP) replacement technologies.

(b) The techno-economic impact of each technology on the products manufactured, and the processes and practices employed by P.K. Construction Co.

(c) The possible implication of each technology, in terms of its known impact on environment, health and safety, such as ozone depleting potential, global warming potential, occupational health, etc.

(d) It was emphasized to P.K. Construction Co. that HCFC technologies are interim in nature due to their residual ODP and therefore may continue to adversely affect the environment, though at a lower scale that CFCs.

(e) It was further explained that HCFCs may become controlled substances under present or future international conventions and will therefore also need to be phased out at a future date, and any investments required for their phase out and

for conversion to safer technologies may have to be borne by P.K. Construction Co.

14. P.K. Construction Co. indicated their preference for selection of HCFC-141b based technology in their manufacture of rigid polyurethane spray/in situ foam insulation. The specific justifications offered by them are as below:

(a) The only zero-ODP technology option for spray/in situ rigid polyurethane foam applications, is fully water-based systems. It is their understanding that fully water-based systems are not yet commercially available or technically satisfactory in India.

(b) Fully water-based systems offer poor insulation value. The densities are also very high (almost 30% higher than the existing CFC-based technology, as per the information they have received from local polyol producers). With such performance drawbacks, P.K. Construction Co. does not consider it advisable to use that technology as it would threaten their competitiveness.

(c) P.K. Construction Co. Have also seen the HCFC technology being implemented successfully by some other enterprises in this line of business in India who had earlier approved Montreal Protocol projects and consider that this technology is proven and acceptable technically and commercially.

15. In view of the above, P.K. Construction Co. have selected HCFC-14lb based systems as the conversion technology while maintaining the product and processing characteristics at acceptable levels.

(e) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulation at R. S. Insulators.

16. The implementing agency expert appraised the prospective recipient enterprise, R.S. Insulators, prior to the preparation of this project document, during August 1998 and had detailed discussions with the technical and managerial personnel of the enterprise, regarding the choice of technology for replacing the existing CFC-based technology, under the project. The enterprise was briefed in detail about the following:

(a) An overview of the available interim (low ODP) and permanent (zero ODP) replacement technologies.

(b) The techno-economic impact of each technology on the products manufactured, and the processes and practices employed by R.S. Insulators

(c) The possible implication of each technology in terms of its known impact on environment, health and safety, such as ozone depleting potential, global warming potential, occupational health, etc.

(d) It was emphasized to R.S. Insulators that HCFC technologies are interim in nature

due to their residual ODP and therefore may continue to adversely affect the environment, though at a lower scale that CFCs.

(e) It was further explained that HCFCs may become controlled substances under present or future international conventions and will therefore also need to be phased out at a future date, and any investments required for their phase out and for conversion to safer technologies, may have to be borne by R.S. Insulators

17. R.S. Insulators indicated their preference for selection of HCFC-141b based technology, in their manufacture of rigid polyurethane foam insulation products and offered the following justifications:

(a) The only zero-ODP technology option for spray/in situ rigid polyurethane foam applications, is fully water-based systems, which presently offers poor insulation value. Their densities are also very high (almost 30% higher than the existing CFC-based technology, as per the information they have received from local polyol producers). With such performance drawbacks, R.S. Insulators. do not consider it advisable to use that technology as it would threaten their competitiveness.

(b) R.S. Insulators. have also seen the HCFC technology being implemented successfully by some other enterprises in this line of business in India who have approved Montreal Protocol projects and consider that this technology is proven and acceptable technically and commercially.

18. In view of the above, R.S. Insulators have selected HCFC-based systems as the conversion technology, as this technology would ensure phaseout of substantial ODP (over 89% cost effectively, while maintaining the product and processing characteristics at acceptable levels.

(f) Conversion from CFC-11 to HCFC-141b technology in the manufacture of rigid polyurethane foam insulated thermoware at Shree Nath Plastics.

19. The implementing agency expert appraised the prospective recipient enterprise, P.K. Construction Co., prior to the preparation of this project document, during August 1998 and had detailed discussions with the technical and managerial personnel of the enterprise, regarding the choice of technology for replacing the existing CFC-based technology, under the project. The enterprise was briefed in detail about the following:

(a) An overview of the available interim (low ODP) and permanent (zero ODP) replacement technologies.

(b) The techno-economic impact of each technology on the products manufactured, and the processes and practices employed by Shree Nath Plastics

(c) The possible implication of each technology, in terms of its known impact on

environment, health and safety, such as ozone depleting potential, global warming potential, occupational health, fire and explosion hazards.

(d) It was emphasized to Shree Nath Plastics that HCFC technologies are interim in nature due to their residual ODP and therefore may continue to adversely affect the environment, though at a lower scale that CFCs.

(e) It was further explained that HCFCs may become controlled substances under present or future international conventions and will therefore also need to be phased out at a future date, and any investments required for their phase-out and for conversion to safer technologies, may have to be borne by Shree Nath Plastics

20. Shree Nath Plastics indicated their preference for selection of HCFC-141b based technology, in their manufacture of rigid polyurethane foam insulated thermoware. The justifications offered by them are summarized below:

(a) Hydrocarbon (pentanes) technology involves fire and explosion hazards. The local laws governing the use of hydrocarbons cannot be complied with, in the existing manufacturing premises of Shree Nath Plastics as they are located in a crowded industrial area. Due to sharp competition in the thermoware market, investments on changing or relocating the factory are not commercially justified at this point.

(b) Thermoware production in India is labour intensive. Therefore, there a large number of workers in the factory at any given time. Hydrocarbon technology will cause a safety and security risk due to the fire and explosion hazard.

(c) The local polyol producers offer stable HCFC-14lb based formulations which are successfully used by their competitors who have earlier participated in the Montreal Protocol programme. They also doubt that pentanes of the necessary grades are easily or economically available for the relatively small quantities they consume.

(d) Shree Nath Plastics also feel that the additional equipment required for using pentane-based technology would present a long-term operation and maintenance challenge in terms of additional costs and trained labour. They would rather opt for simple and rugged equipment, which is adequate for HCFC-based systems.

21. Shree Nath Plastics believe that HCFCs are significantly safer than CFCs for the environment, and the change-over is quick and cost-effective as compared to other options. They would therefore prefer HCFC technology after considering all the merits and demerits of other options.

Appendix II

Projected techno-economic impact of zero-ODP technologies
(Ganga Thermowares P. Ltd)

1. The following table summarizes the projected impact of applying various zero-ODP technologies with respect to the selected technology(HCFC-141b) in this project:

TYPE OF FOAM SYSTEMS	PROJECTED TECHNO-ECONOMIC IMPACT				
	TECHNICAL/COMMERCIAL IMPLICATIONS		Estimated cost implications (US $)		
	MERITS	Demerits	Additional costs	Savings	Net Impact on costs
Pentane based	Zero ODP, GWP	Safety hazars: installation of safety systems and relocation of plant required	400,000	0	400,000
		Increased foam density and thermal conductivity	35,000	0	35,000
		Retrofitting foam dispenser	80,000	0	80,000
		In-house blending required	80,000	0	80,000
	Less expensive		0	20,000	(20,000)
	NET IMPLICATION ON PROJECT COSTS				**575,000**
Water-based	Zero, ODP, GWP	Increased foam density (25%)	35,000	0	35,000
		Increased thermal Conductivity (25%)	20,000	0	20,000
		Products will become un-competitive and operations will be un-viable, leading to losses and closure	50,000	0	500,000
	NET IMPLICATION ON PROJECT COSTS				**555,000**

2. **Pentane (n, iso, cyclo) based systems** meet most selection criteria and are the preferred option, when safety issues can be addressed cost-effectively. The relatively high investments for safety costs tend to limit pentane use to relatively large CFC users. In addition, the use of pentane is limited to those enterprises whose facilities can be adapted to meet safety requirements, and can be relied on to maintain safe operations. In case of this enterprise, use of pentane based systems will require introduction of in-house blending, extensive plant modifications and also the relocation of the premises, to ensure safe operation conforming to local regulations. There are also expected penalties on density and thermal conductivity with

respect to HCFC-141b technology. **The net additional impact on project costs with pentane based systems, is expected to be about US $575,000 with respect to HCFC-141b technology.**

3. **Water-based** systems are an alternative in cases where pentane is not feasible due to safety concerns, cost efficiency or availability. Water-based systems are, however, more expensive than other CFC-free technologies due to reductions in insulation value (requiring larger thickness) and lower cell stability (requiring higher densities). Water-based systems can be applied where insulation performance is relatively less critical. But in case of the enterprise, which manufactures insulation products, thermal conductivity is crucial. Moreover the presently available water-based systems lead to an unacceptable increase in density. Due to these reasons, applying water-based systems in this project will make the enterprises' products un-competitive and may even lead to closure of the operations. **The net additional impact on project costs, with water-based systems, is expected to be about US $555,000 with respect to HCFC 141b technology.**

4. **HFC-134a based systems** are not offered in the applicable regional area and are not a feasible-ODP option.

5. **Liquid HFC based systems** do not meet requirements on maturity and availability at the present time.

6. Thus, the selection of HCFC-141b based systems, as the preferred conversion technology, is justified taking into account all the technical, commercial and cost factors.

Estimated cost of future conversion to zero-ODP technology

7. At the present time, there are no zero-ODP technology options, which can be applied cost-effectively for this project.

8. The following possibilities exist for a future conversion to zero –ODP technology, based on information available presently:

(a) Relocation of the enterprise to premises that can allow safe implementation of hydrocarbon based systems. If this relocation takes place at the cost of the enterprise, then a future conversion to hydrocarbon technology is expected to cost about US $200.000.

(b) If and when liquid HFC or water-based systems become technically mature and commercially available, then the investment required to apply this technology, are expected to be negligible.

PROJECT EVALUATION SHEET
INDIA

SECTOR: REFRIGERATION ODS use in sector (1991): 1,990 ODP tonnes

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

Project Titles:
(a) Elimination of CFCs in the manufacture of domestic refrigerators at Whirlpool of India Ltd.

Project Data	**Domestic**
	Whirlpool
ODS phase-out (ODP tonnes)	364
Proposed project duration (months)	36
Incremental capital cost (US $)	1,105,000
- including contingency (%)	10
Incremental operational cost (US $)	4,308,000
Total project cost (US $)	5,413,000
Local ownership (%)	42.6
Export component (%)	0
Amount requested (US $) {Original}	2,305,938
{Revised}	
Cost effectiveness (US $/kg)	6.79
National Coordinating Agency	Ministry of Environment and Forests (MoEF)
Implementing Agency	IBRD
Technical review completed?	Yes

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

PROJECT DESCRIPTION

(a) Elimination of CFCs in the manufacture of domestic refrigerators at Whirlpool of India Ltd.

1. The project proposal was submitted to the 26th Meeting of the Executive Committee (UNEP/Ozl.Pro/ExCom/26/70, Pages 8 to 12). Following an extensive discussion the Executive Committee decided to defer the project until its next meeting, prior to which more information should be made available to Executive Committee members on the reasons for the selection of the technology proposed, as well as figures on production level (Decision 26/32).

2. The World Bank prepared additional information regarding the selection of HCFC-141b technology for foaming operations in Whirlpool and explanation for he production level used in calculation of eligible incremental operating cost. As required by the Executive Committee decision, the note from the World Bank is attached in the Annex I.

3. The project is submitted for individual consideration by the Sub-Committee on Project Review.

SECRETARIAT S COMMENTS AND RECOMMENDATIONS

COMMENTS

9. The eligible incremental capital cost of the project was agreed with the World Bank at US $403,370, excluding support cost.

10. The incremental operating cost of the project will be calculated based on a decision of the Executive Committee regarding information on figures on the production level as requested by it in Decision 26/36.

11. The support cost for the World Bank will be computed on the basis of the agreed capital cost and the amount of incremental operating cost to be agreed.

12. The project proposal included incremental operating costs associated with compressors. These costs are not requested at this stage and will be dealt with later on the basis of Decision 26/36.

Annex I

DRAFT

India: Elimination of CFCs in the manufacture of domestic refrigerators at Whirlpool of India Ltd.
Note on information required for consideration of the proposal

The Whirlpool project proposal was considered a the 26th meeting of the ExCom, and deferred until the next meeting, prior to which more information was required be made available to Executive Committee members on the reasons for selection of the technology proposed, as well as figures on production levels (Decision 26/32).

1. Selection of technology: The project proposes to phase out use of CFC-11 and CFC-12 in the manufacture of domestic refrigerators by converting the foam operations to HCFC-141b based systems and refrigerant operations to HFC-134a. The technology to be clarified is the selection of HCFC-141b based systems for conversion of the foam operations. Comments were received from Whirlpool of India Limited (by the Bank's consultant), as well as from Whirlpool Corporation, USA. Whirlpool have provided the following reasons for the choice of HCFC-141b rather than cyclo-pentane based systems for the conversion of the foam operations.

(i) ***Substitutes for Polyurethane insulation foam.*** 50% reduced CFC-11 formulation foam, HCFC-141b and similar HCFC reduced ODS solutions were initially seen as substitutes for CFC blow insulation foam for domestic refrigerators. Both provided a quick reduction of CFC-11 use as blowing agent and reduction of ODP consumption. It was also clearly seen as a transitional solution until the identified HFC-substitutes become commercially available. Whirlpool and many other multinational refrigerator manufacturers selected the HCFC 141b transitional strategy aiming for HFC as the end solution, expecting that HFC blowing agents would be commercially available around year 2002/2003. As most of the existing foaming equipment in such companies can be used with only minor changes, HCFC-141b is also seen as a low capital costs solution. The additional costs of HCFC 141b compared to CFC-11 was not seen as a major problem, even if it resulted in increased production costs, (incremental operating costs). Part of the strategy was also that the existing foaming equipment would be able to work with the future HFC-blowing agents, e.g. HFC-245a and HFC-365f.

(ii) ***HCFC is acceptable under current national policies.*** Before any funding is requested from the MLF for projects from India, the projects are reviewed by a committee established by the Ozone Unit. The projects are reviewed and endorsed by the government of India on technical grounds. India does not have a national policy regarding use of substitutes and allows companies to select the substitute they consider appropriate for their purpose, - as long as it is recognized as a proven technology, allowed under the Montreal Protocol and the substitute is commercially available in India.

(iii) ***The premises not equipped to handle a flammable blowing agent.*** The present facility is located near New Delhi and was established in 1960 by the erstwhile Kelvinator of India Ltd., from whom it was acquired by Whirlpool in 1996. The factory is situated in a congested industrial area, surrounded by a large number of small manufacturing units. The local residential and commercial district has expanded over the years and is now in close proximity to this plant. Whirlpool India had already identified and decided to go through the HCFC-141b route as a transitional solution when the enterprise ordered new foaming equipment and expanding its production capacity. The present equipment allows Whirlpool India to convert to HCFC-141b as blowing agent with a capital investment of less than US$ 500,000. It also allows Whirlpool to convert to HFC later, when commercially available without additional capital investment costs. By selecting the HCFC-141b strategy, Whirlpool India could utilize the Whirlpool technology already available.

(iv) ***Conversion to hydrocarbons may be technically possible, but safety would be a concern***. With the location of the factory and the layout of the factory, it would require change of layout of the production possible expansion of the facility. The proximity to surrounding industrial, residential and commercial districts would in any case make it difficult to obtain compliance with Indian safety requirements, which specify minimum distances between an industrial activity using hazardous substances and local commercial and residential areas. Technology is available from main refrigeration equipment suppliers and safety measures can be taken to minimize the risk associated with the production and daily operation. However, a major safety concern would be associated with the location of the production facility in the middle of the town and the requirement of weekly delivery of hydrocarbon by a 10 MT tank truck.

(v) ***Much higher capital costs would be required.*** The capital costs of converting the present foaming operation at Whirlpool would be in the order of US$ 2 to US$ 2.5 million. This would cover modification of some part of the foaming lines and replacement of other parts, installation of exhaustion systems, safety measures in the production area as and surrounding areas as well as underground hydrocarbon storage tanks. As Whirlpool does not have the same degree of experiences on hydrocarbon technology, product development costs will be higher. Furthermore most of the investments would be related to foaming equipment installed after July 1995, only 30 to 40% of the investment costs would be eligible for funding under the present policies of the MLF, while the remaining costs would have to be covered by the enterprise.

(vi) ***Whirlpool s other factory in India produces no-frost refrigerators with HCFC-141b.*** Whirlpool has set up another plant near Pune, in India for producing no-frost refrigerators based on HCFC-141b technology. To achieve economy in their operations, Whirlpool preferred to use the same technology in both factories.

Whirlpool India are fully aware of the technical options available for insulation PU foam for the domestic refrigeration industry. The conversion strategy from HCFC-141b to HFC was adopted by Whirlpool International at a very stage. HCFC Technology are fully developed and extensive experiences has been gained during the past years. Furthermore,

with the expected change to HFC in 4 to 6 years, it would not make sense to change the corporate strategy at this point, also taking into account the additional costs to be covered by Whirlpool in changing to hydrocarbons.

2. Production levels: In accordance with Executive Committee guidelines, only production capacity installed before 25 July, 1995 is eligible for MLF funding. As the production was expanded and some existing equipment replaced in 1996, the eligible production capacity has to be based on the 1995 capacity. It is known that a number of units produced in the last twelve months before July 1995 were insulated with mineral wool, but no records were available to determine the numbers insulated with mineral wool. Based on the pre-1995 production equipment, the eligible production for the foam part was agreed with the Secretariat as 350,000 units. This number (350,000 units) was used for the calculation of the incremental operating costs for the foam part. Actual production before July 1995 was used to calculate the incremental operating costs for the refrigeration part.