PROJECT DOCUMENT

Bangladesh

UNDAF Outcome(s)/Indicator(s):
(Link to UNDAF outcome. If no UNDAF, leave blank)

2.2 Survival and development rights of vulnerable groups are ensured within an environmentally sustainable framework

Expected Outcome(s)/Indicator (s):
(CPAP outcomes linked to the MYFF goal and service line)

2.1 Carrying capacity of environment and natural resources base is enhanced, National/ sectoral policy and planning to control emissions of ozone-depleting substances

Expected Output(s)/Indicator(s)
(CPAP outputs linked to the above CPAP outcome):

Phase out of the Ozone Depleting Substances (ODS)

Implementing partner:
(designated institution/Executing agency)

Department of Environment of the Ministry of Environment & Forests

Programme Period: 2011-2013
Key Result Area (Strategic Plan):

Project Title: Conversion from HCFC-141b to cyclopentane technology in the manufacture of insulation foam in domestic refrigerators at Walton Hi-Tech Industries Ltd, Bangladesh

Project ID: 000 81038
Award ID: 000 64169
Project Duration: 2 years
Management Arrangement: National Implementation Modality

Total budget: USD 1,146,074

Allocated resources:
- Government
- MP USD 1,146,074
- In kind contributions

Narrative

This project, upon completion, will result in a phase-out of 183.7 metric tonnes (2009 data) of HCFC-141b consumption by converting to cyclopentane technology in manufacture of insulation foam for domestic refrigerators at Walton Hi-Tech Industries Limited and significantly contribute towards Bangladesh's compliance with 2013 and 2015 control targets.

Agreed by (Implementing Partner): Monowar Islam, Director General, Department of Environment, ~~Ministry of Environment & Forests~~ Date 27.12.2011

Agreed by (Government): Dileep Kumar Das, Joint Secretary, Economic Relations Division, Ministry of Finance, Govt. of the People's Republic of Bangladesh Date 27.12.2011

Agreed by (UNDP): Date 28/12/11

Mohammad Rafi Tokhi
Country Director a.i.
UNDP- Bangladesh

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET -NON-MULTI-YEAR INVESTMENT PROJECTS

COUNTRY: **BANGLADESH**

IMPLEMENTING

UNDP

PROJECT TITLE:

Conversion from HCFC-141b to cyclopentane technology in the manufacture of insulation foam in domestic refrigerators at Walton Hi-Tech Industries Ltd, Bangladesh

NATIONAL COORDINATING AGENCY: Ozone Cell, Department of Environment, Government of Bangladesh

LATEST REPORTED CONSUMPTON DATA FOR ODS ADDRESSED IN THE PROJECT: 2009

A. Article-7 Data (ODP tonnes for 2009, as of August 2010

Annex-C, Group-I substances (HCFCs)	67.8

B. Country Programme Sectoral Data (ODP Tons for 2009, as of August 2010):

Substance	Total
HCFC-22	46.7
HCFC-141b	20.9
HCFC-142b	-
HCFC-123	0.1
HCFC-225ca	-
HCFC-225cb	-

ODS CONSUMPTION REMAINING ELIGIBLE FOR FUNDING (ODP Tonnes):	N/A
CURRENT YEAR BUSINESS PLAN	N/A

PROJECT DATA			
Sector:	Foam		
Sub-sector:	Domestic refrigeration insulation foam		
ODS use in sector (2009 metric tonnes):			190.00
ODS use in sub-sector/application (2009 metric tonnes):			183.70
Project impact (metric tonnes)			183.70
Project duration			24 months
Project Costs:	Incremental Capital costs	US $	932,500
	Contingencies:	US $	93,250
	Incremental Operating Costs:	US $	120,324
	Total Costs:	US $	1,146,074
Local ownership:			100%
Export to non-A5 countries			0%
Requested grant:			1,146,074
Cost-effectiveness (US$/kg-ODS/year)			6.24
Implementing agency support costs:		US $	85,956
Total cost of Multilateral Fund:		US $	1,232,030
Status of counterpart funding:			N/A
Project monitoring milestones included (Yes/No)			Yes

PROJECT SUMMARY

This project, upon completion, will result in a phase-out of 183.7 metric tonnes (2009 data) of HCFC-141b consumption by converting to cyclopentane technology in manufacture of insulation foam for domestic refrigerators at Walton Hi-Tech Industries Limited and significantly contribute towards Bangladesh's compliance with 2013 and 2015 control targets.

Prepared by: UNDP in consultation with the enterprise and NOU — **Date:** 25 September 2010

Reviewed by: Mary Courtney, UNDP Foam Sector Reviewer — **Date:** 02 October 2010

PROJECT OF THE GOVERNMENT OF BANGLADESH

Conversion from HCFC-141b to cyclopentane technology in the manufacture of insulation foam for domestic refrigerators at Walton Hi-Tech Industries Limited

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of HCFC-141b in the manufacture of insulation foam for domestic refrigerators in Walton Hi-Tech Industries Limited, Bangladesh. This will result in phasing-out 183.7 MT of HCFC-141b in Bangladesh (2009 equivalent).

2. SECTOR BACKGROUND

In Bangladesh, HCFCs are mainly consumed in refrigeration and air-conditioning applications and foam applications. The main HCFCs that are consumed in the country are HCFC-22 and HCFC-141b. HCFC-123 is consumed in minor quantities (less than 1% of the total consumption of HCFCs). The consumption of HCFCs over the last three years is given in the table below.

(All figures in MT)

Substance	2007	2008	2009
HCFC-123	-	6.0	8.0
HCFC-141b	45.0	120.0	190.0
HCFC-22	586.0	925.0	848.9
Grand total	**631.0**	**1,051.0**	**1,046.9**

Source: Article 7 data report for the years 2007, 2008 and 2009.

HCFC-141b is used in Bangladesh in manufacturing foam products. The consumption of HCFC-141b in Bangladesh is growing and as can be seen from the table above, it has increased from 45 MT in 2007 to 190 MT in 2009. Currently, HPMP survey is underway in Bangladesh. Survey results will present complete information on HCFC-141b consumption in the country.

In Bangladesh, Walton Hi-Tech Industries Ltd is the largest manufacturer of refrigerators and uses HCFC141b in manufacturing insulation foam. In 2009, their annual production was about 283,000 units. The estimated market size of domestic refrigerators in Bangladesh is about 600,000 units in 2009 and it is estimated that about 317,000 units are imported in Bangladesh. Walton Hi-Tech Industries Ltd is the market leader in sales of domestic refrigerators with about 50% market share. The company has around 800 dealer outlets distributing their products in Bangladesh. The other main brands of domestic refrigerators sold in the market are LG-Butterfly, Haier and Singer. Refrigerators are imported from China, India and Thailand.

The demand for refrigerators is growing with rapid urbanization, due to the increasing purchase power of the rural people and falling prices of appliances. The expected growth rate in the refrigerator market is about 15% in the next two to three years. Walton Hi-Tech Industries Limited is targeting higher market share in the growing domestic refrigerator markets.

The Ozone Cell, Department of Environment is leading efforts for phasing out ODSs in Bangladesh. They work closely with other regulatory agencies and users/suppliers of ODS using equipment and products for achieving their targets.

3. ENTERPRISE BACKGROUND

Walton Hi-Tech Industries Limited is the largest and only domestic refrigerator manufacturer in Bangladesh. The enterprise is 100% indigenously owned and was established in April 2006. The enterprise commenced production in September 2006. The company employs 33 managerial Staff, 150 technical staff and around 2,400 workers.

Walton uses HCFC_141b technology for foaming of refrigerators. Their total consumption of HCFC-141b in the year 2009 was 183.7 MT. There are two production lines located in Unit 1 and Unit 2 which have production capacity of 1,200 pieces per day and 1,000 pieces per day, respectively. Their manufacturing facility is located in Chandra Kaliakair, Gazipur, Bangladesh.

The company manufactures domestic refrigerators using HCFC-141b as foam blowing agent. The quantity of foam chemicals and HCFC-141b used by the company for the year 2009 is given in the table below.

Model / Capacity	Production in 2009	Foam (gms / unit)	Blowing Agent (gms/unit)
145Liter	28.896	5.394	515
160Liter	16.135	5.313	508
170Liter	10.449	4.262	407
185Liter	10.809	7.923	757
190Liter	42.097	6.526	624
191Liter	15.715	6.514	622
201Liter	10.440	7.817	747
205Liter	32.137	6.648	635
210Liter	10.680	6.794	649
213Liter	37.912	6.736	644
220Liter	32.160	6.300	602
240Liter	12.311	9.634	920
244Liter	11.505	9.316	890
273Liter	11.354	10.710	1.023
Weighted average		**6,801**	**650**

4. PROJECT DESCRIPTION

Baseline situation

As mentioned earlier, the company has two production lines manufacturing insulation foam using HCFC-141b. The total capacity of these two lines is about 2,200 units per day (24 hour equivalent capacity). These two lines are proposed to be converted under this project.

Chemical storage: At the manufacturing facility, all the chemicals are stored at the steel drums at the warehouse.

Premixing unit: HCFC-141b is mixed with polyol by a blender and stored in 250 kg steel drums. The blended polyol and the isocyanate are supplied to the foaming machine from the drums though feed pumps. The foaming machines have day tanks, which supply the chemical to the mould to create the insulation inside the refrigerator door and cabinet.

Foam dispensers: The baseline foam equipment for the manufacturing facilities is as below:

Make	Hennecke (Germany)	Hennecke (Germany)	Cannon (Italy)	Yuyao Weilomg China
Model	HK-650	HK-270	100-Penta-Twin	HAF100-2H
Year purchased	2006	2006	Jan - 2007	March - 2007
Year Installed	2006	2006	Feb - 2007	March - 2007
Capacity (lit/min)	160 (4 pumps)	32 (2 pumps)	66	80
Foaming for	Cabinets	Doors	Cabinets and doors	Cabinets and doors

Cabinet and door foaming fixtures: The baseline for this equipment is as below.

Cabinet line	Door line	Cabinet and door line
Unit 1		Unit 2
1	1	1
12 jigs	7 jigs	12 jigs
Electric heating	Electric heating	No electric heating

5. CONVERSION

Walton Hi-Tech Industries Limited will phase out the usage of HCFC-141b in its manufacturing of refrigeration equipment by converting foam operations to cyclo-pentane based systems.

Changes in its manufacturing operations to cyclopentane based systems will involve the following:

a) Change in mixing ratios, causing reduced dispenser output, increased viscosities leading to reduced flowability of the chemical mixture. The foaming reaction parameters will change.
b) The miscibility of Cyclopentane with polyol is significantly less than that of HCFC-141b.
c) Cyclopentane based foam has higher thermal conductivity than HCFC-141b. This will require compensation by way of using optimized formulations.
d) The Cyclopentane based foam tends to have a higher density resulting in increased requirement of chemicals.
e) Extensive modifications to the plant/process will have to be carried out and ventilation, monitoring and safety systems will have to be introduced, to ensure the safe operation of the plant with cyclo-pentane.

Foam operations

1. Cyclopentane of the required purity/grade is available through imports. A safe, reliable, convenient and economical storage, delivery and handling system for cyclopentane is required, comprising of the following:
   i) *Storage*: This is proposed to be provided through the installation of an under/above ground carbon steel storage tank of 60 cu.metre capacity. The capacity of the storage is determined based on procurement requirement of cyclopentane which needs to be imported from Germany, time relating to entire order to delivery cycle, procedural requirements for port inspection and clearance, return time for the cylinder and risks associated with timely availability of materials.
   ii) *Delivery*: 2 delivery pumps for cyclopentane will have to be installed, 1 operating and 1 standby. The electric drive motors shall have explosion proof rating.
   iii) *Handling*: Piping and fittings for carrying the cyclopentane from the storage tank to the pre-mixing unit. Also, piping and fittings for receipt of supply of cyclopentane, including gas return and pressure relief lines will be required.

2 The existing pre-mixing arrangement is batch-type and not suitable for ensuring efficient and safe mixing of cyclo-pentane in the polyol. A new pre-mixing station comprising of a closed-system static mixer, a jacketted buffer tank, metering/recirculating pumps for the components and chemical loading pumps, that incorporates the safety requirements for cyclo-pentane, will need to be installed.

3 The proposed plan for retrofit / replacement of the dispensers is given below.

Make	Hennecke (Germany)	Hennecke (Germany)	Cannon (Italy)	Yuyao Weilomg Polyurethane, China
Model	HK-650	HK-270	100-Pentane-Twin	HAF100-2H
Conversion plan	Retrofit	Retrofit	None	None

4 The existing inter-connecting high pressure piping and fittings for transfer of the chemicals, between the batch pre-mixer, foam dispenser and the mixing heads, will need to be dismantled and replaced for handling cyclo-pentane formulations for safety reasons and due to the proposed new layout.

5 The existing cabinet foaming operations will have to be modified as under:

a) The electrically heated fixtures will need to be retrofitted for water heating.
b) Existing 12 cabinet foaming jigs need to be retrofitted with water heating system.
c) The existing electric preheating oven will need to be replaced with a new oven for use with cyclo-pentane formulations. This is because presently the structure of the heating oven is integrated with the platform for the existing dispenser. The dismantling of this platform for relocation with the new dispenser will require dismantling of the oven structure also. Further, the heating will need to be accomplished with hot water instead of electric resistance heaters for safety reasons. Hot water system with necessary heating oven modifications need to be added.
d) One additional cabinet fixture is proposed to be added.

6. The existing 7 door foaming fixtures in Unit 1 are electrically heated. It is proposed that 7 door foaming fixtures are retrofitted to make them suitable for water heating.

7. There is no existing water conditioning system, except the small dedicated chiller unit for the existing foam dispenser. It is proposed that new water conditioning system, to provide both heating and cooling be installed at a convenient central location. This would be economic and convenient because the distances involved are relatively modest. This system would comprise of:

a) An electric water heater with necessary controls with capacity adequate to meet the heating requirements for the pre-mixing buffer tank, component day tanks on the dispenser, preheating oven and the cabinet foaming fixtures and pump for circulation of the hot water.
b) A water chilling unit with necessary controls, with capacity adequate to cover the cooling requirements for the pre-mixing buffer tank and component day tanks on the dispenser, and circulation pump.
c) Interconnecting steel piping, valves, fittings and the necessary insulation for circulation of hot and cold water to the pre-mixing station, foam dispenser, cabinet foaming fixtures and pre-heating oven.

d) Expansion cum storage tanks with insulation, for hot and cold water, controls and instruments.

8. A ventilation and exhaust system for maintaining safe concentrations of cyclo-pentane will be

required. This will involve sheet metal ducting and blowers/fans for supply air as well as for exhaust of air extracted from the following vulnerable locations:

a) The pre-mixing station area.
b) The foam dispenser area.
c) The cabinet foaming area.

9. A safety system for detection and monitoring of hydrocarbon concentrations and for prevention of fire and explosion hazards will be required. This will comprise of the following:

a) Hydrocarbon sensors/detectors (about 30 Nos at assorted locations)
b) Alarm and control system
c) Water sprinkler system for fire extinguishing, covering the vulnerable areas and about portable fire-extinguishers for areas unsegregated from the vulnerable areas
d) A nitrogen system for mold flushing to prevent static electricity generation (and will also be used for drying the components of the refrigeration system)
e) Anti-static floor treatment for the vulnerable areas amounting to about 300 sqm.

10. Electrical works for the conversion complying with safety regulations pertaining to areas handling flammable/explosive substances, will be required, covering the following:

a) A main control panel and local distribution panels for the new electrical equipment (cyclo-pentane pump motors, pre-mixing station pump motors, dispenser pump motors, water pumps motors, fan motors, compressor motor, etc)
b) Power cabling, earthing and terminations
c) Control and interlocking wiring for the safety systems
d) Back-up AC electric power generator covering the requirements of the ventilation, fire extinguishing, alarm and nitrogen systems.

11. Civil and miscellaneous works will be required covering the following:

a) Excavation and refilling for the underground cyclo-pentane storage
b) Cyclopentane pumps foundations and housing
c) Miscellaneous civil works for pipe/duct/cable support installation, making and refinishing wall/floor openings, floor finishing, relocation of the dispenser, supports/foundations for installation of new equipment, etc.

12. Technical assistance from external process experts, to implement the new formulations and to ensure smooth transition to the new technology, will be needed.

13. Trials will be needed for validation of the new formulations and the new equipment. This will cover the cost of chemicals, raw materials/consumables and utilities required during the trials and commissioning.

14. On commissioning the plant, a safety audit will be required to be carried out and the plant safety established by a competent authority through inspection and certification.

15. Product testing followed by certification, with special emphasis on energy efficiency, in view of the higher thermal conductivity of hydro-carbon based rigid foam is envisaged to be carried out on one prototype of each refrigerator model, from external agencies.

16. The production personnel in the enterprises will be required to be reoriented to be able to work with the new formulations. Additionally, training for establishing safe practices in handling flammable/explosive substances will be required to be imparted. Such training will either be secured from specialized agencies or through pre-trained officials of the enterprise.

Investments will be needed to be made and provisions thereof included in the project budget, to cover the incremental costs of these changes. These changes will also result in incremental operating costs, for which provision has been made in the project budget. These incremental costs originate from the increased costs of HC formulations as compared to the existing HCFC-141b based systems.

6. JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

The selection of the alternative technology would be seen to be governed by the following considerations:

a) Proven and reasonably mature technology.
b) Cost effective conversion.
c) Availability of the systems at favorable pricing.
d) Critical properties that have to obtained in the end product (in this project -thermal conductivity, dimensional stability, closed cell content, surface properties and strength)
e) Compliance with established (local and international) standards on safety and environment.

Overall assessment of technology options are provided in the Annex-2 to this document.

From the permanent technologies, the HFC-based systems (either liquid or gaseous), though promising, are not yet extensively adopted due to their higher operating costs and high-GWP of HFCs. For water-based systems, the densities, insulation values and commercial availability are unsatisfactory at present. The penalty of incremental costs for water based systems for large scale users offset the environmental advantages. Methyl formate-based systems are also currently at initial stages of adoption in the market.

The pentane based (n-, iso-,cyclo) systems require extensive safety related provisions/investments, that are justified in case of large scale users, due to the relatively favorable operating costs. Due to safety considerations, the use of preblended systems is not viable. Pentane based systems are environmentally acceptable (zero ODP, no health hazards) and constitute a permanent technology. Cyclopentane based systems have been widely used as the technology of choice for the manufacture of domestic refrigerators. The enterprise has therefore chosen this technology.

Safety implications

The use of flammable substances such as cyclopentane requires substantial changes in the production facilities and practices. Conformity to strict safety standards is a requirement of MLF funded projects. The following safety concept is proposed to be applied:

- Classify all identified hazard areas following IEC-79-10 (1986):

  Zone-0: Where a constant amount of highly flammable/explosive substances is expected. Areas inside the cyclopentane piping and tanks are considered in this category. All materials and devices must be explosion-proof (EX) and properly grounded.

  Zone-1: Where highly flammable/explosive substances are periodically expected. Areas around molds, fixtures and tooling are considered in this category. All materials and devices must be explosion-proof (EX-e, EX-d or EX-ia) and properly grounded. With adequate ventilation, Zone-1 can be reclassified to Zone-2.

  Zone-2: Where highly flammable/explosive substances can be expected only during an accident or scheduled maintenance. Exterior of storage areas, premixing stations and foam dispensers are generally in this category. All materials and devices must be explosion-proof (EX-n or IP-54 sealing) and properly grounded.

- Apply engineered solutions, such as ventilation, ionized blowers, static eliminators, segregating walls, etc.
- Safeguard areas, which cannot be reclassified, by explosion-proofing.
- Provide additional safeguarding through a gas monitoring and detection system with sensors located at/near potential emission points and also portable gas detectors to be used as a part of a formal monitoring plan, for areas which do not have formal monitoring.
- Provide adequate emergency response gear, such as fire extinguishers.
- Provide adequate personnel training for safe operating procedures, preventive maintenance and emergency response, using formalized procedures, preparation of safety manuals and an emergency response plan.
- Use external experts for supervising designs, implementation and start-up.

7. PROJECT COSTS

The total project cost is estimated at US$ 1,146,074.

The Incremental Capital Costs of US$ 932,500 include capital investments required on high pressure foam dispensers retrofits, cyclopentane storage and handling system, ventilation and safety systems, trials, technical assistance and training. The breakdown of these is provided separately for the foaming and refrigeration operations, in Annex-1.

The Incremental Operating Costs of US$ 120,324 represent the incremental operating costs with the new technology for one year post-project operation and do not reflect growth. Details are provided in Annex-2.

Contingencies of US$ 93,250 (10%) for adequate funding of incremental capital costs.

8. COST EFFECTIVENESS

The Cost Effectiveness (ratio of the total incremental costs to the net metric kg of HCFC-141b phased out per year post-project) of this project works out to US$ 6.24/kg/y of HCFC-141b phased-out. This has been calculated from the net incremental project costs of US$ 1,146,074 and the total HCFCs of 183.7 MT to be phased out in the first year of operation post project. The detailed calculations are provided in Annex-3.

9. FINANCING :

The enterprise requests a total grant funding of **US$ 1, 146,074**

10. IMPLEMENTATION SCHEDULE

MILESTONE	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Start-up of project activities	X	X						
Submission of project document or grant agreement for signature	X	X						
Project document signature		X						
Signature of Memorandum of Agreement with enterprise		X	X					
Verification of milestone and project monitoring				X	X	X	X	X
Decommissioning and destruction of redundant baseline equipment							X	X
Submission of completion report								

11. RESULTS

This project will eliminate the use of 183.7 MT of HCFC-141b (2009 equivalent) annually.

12. IMPLEMENTATION ARRANGEMENT:

The Project will be implemented under National Implementation Modality over two year from 2011 & 2012 as approved by Montreal Protocol. Department of Environment (DoE), Ministry of Environment and Forest (MoEF) is the main implementing partner. The national counterpart for this project is the National Ozone Unit (NOU) of Department of Environment (DoE) under Ministry of Environment and Forest (MoEF).

Director General, DoE is the National Ozone Focal Point and the National Project Director of the INS Project will be the alternate Focal Point for this Project as approved by Montreal Protocol and Chemicals Unit of UNDP.

National Ozone Unit of DoE will act as the Project Management Unit and will provide logistics and secretarial supports for implementation of the Project. Senior Manager of the INS Project will act as the Project Manager of the Project.

Work plans will be the main management instrument governing the implementation of the project. The National Ozone Unit of DoE prepares an Annual Work Plan with well-defined result indicators, using standard format for UNDP supported project. Annual Work Plans will be appraised and endorsed by the NPD and UNDP. Upon approval, the work plan will be an instrument of authorization to the National Ozone Unit for implementation of the project. HR mobilization and procurement plans would be added to the AWP as annex and would be subject to review and endorsement by the NPD and UNDP.

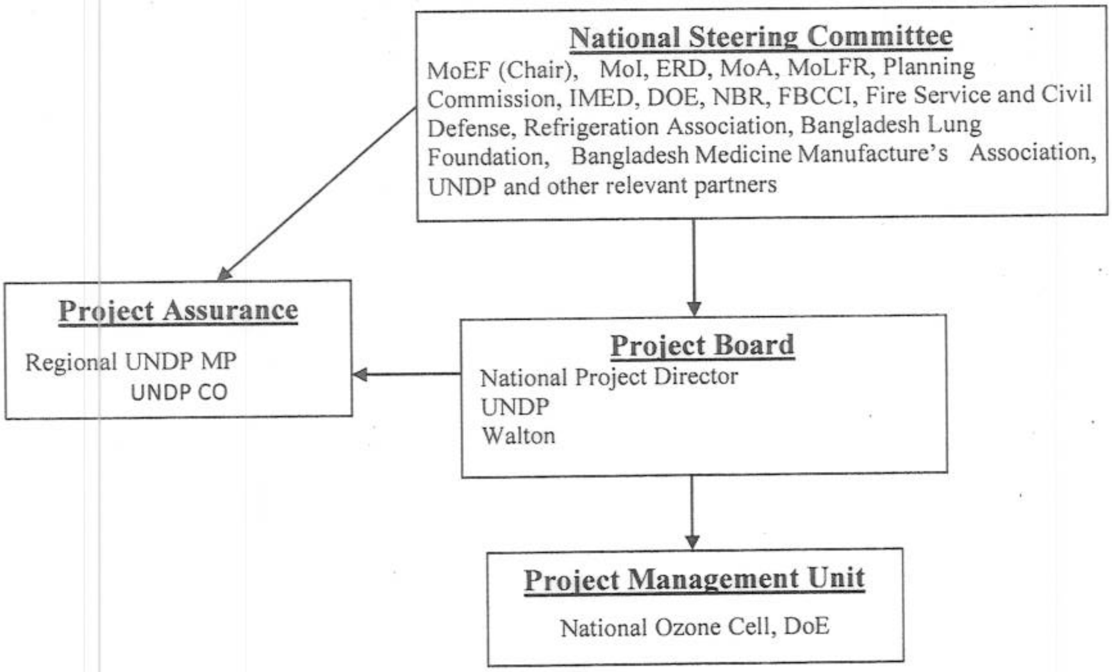
The NPD, with approval from the appropriate authority of the National Implementing Partner, is authorized to operate the project account with a national commercial bank, under a joint signatory arrangement. The project account must be a current account, which may yield interest if provided for by the local financial system. Under no circumstance should UNDP funds be deposited into a separate bank account for interest bearing purposes. The NPD arranges opening of a project account before submitting a request for the first quarter disbursement, as an advance, from UNDP. UNDP will advance funds for a three-month period in the dedicated accounts to be maintained by the implementing partners exclusively for this project.

At the end of the three-month period, the NPD will submit elaboration of expenses in Fund Authorization and Certificate of Expenditure (FACE) format that will be reviewed by UNDP before the release of funds for the next quarter. Funds will be directly disbursed to the other national implementing partners/ministries from the dedicated project account as per approved annual work plan and budget of the project.

a) Outcome Board/National Steering Committee: The Outcome Board/National Steering Committee will meet at least twice in a year. It is the highest oversight body and will ensure that the project is significantly contributing compliance of phase out of HCFC-141b consumption. The Secretary of MoEF will chair the meetings of the National Steering Committee, and representation from other ministries will not be below the rank of Joint Secretary. Other members of the National Steering Committee will include the MoI, ERD, MoA, MoLFR, Planning Commission, IMED, DOE, NBR, FBCCI, Fire Service and Civil Defense, Refrigeration Association, Bangladesh Lung Foundation, Bangladesh Medicine Manufacture's Association, UNDP, and others relevant may be co-opted. Details are given in the Project Organogram.

b) Project Board: The Project Board will meet once per quarter, or more frequently as necessary. Work of the Project Board will be guided by the continuous review, alignment and approval of Annual Work Plans (AWPs), which will be endorsed by the Implementing Partners and UNDP. The Project Board will consist of: (1) the National Project Director (NPD) (the Executive), representing project ownership and chairing the Project Board. (2) a UNDP representative in the role of Senior Supplier (representing the interests of the parties concerned which provide funding and/or technical expertise to the project) will provide guidance regarding technical feasibility and support to the project, and (3) Representatives of other implementing partner organizations i.e. Walton. .

Organogram of the Project



13. LEGAL CONTEXT :

This project document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement (SBAA) between the Government of the People's Republic of Bangladesh and UNDP, signed on 25 November 1986.

Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the executing agency and its personnel and property, and of UNDP's property in the executing agency's custody, rests with the executing agency.

The executing agency shall:

a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
b) assume all risks and liabilities related to the executing agency's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The executing agency agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed at http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

ANNEX – 1
Incremental Costs

Incremental Capital Costs

No	Item	Cost (US$)
1	Cyclopentane storage and handling system	75,000
2	Premixing equipment	90,000
3	Retrofit of existing foam dispensers (2)	150,000
4	Foaming fixture and heating system retrofit	207,500
5	Water conditioning system	20,000
6	Ventilation and exhaust system	60,000
7	Fire safety system	180,000
8	Civil and electrical works	80,000
9	Technical assistance from external experts	30,000
10	Trials	20,000
11	Safety audit/certification	10,000
12	Process and safety training	10,000
Sub-total		**932,500**
Contingencies (10%)		93,250
Total		**1,025,750**

Incremental Operating Costs

Before	1,028,408 kg systems at US$ 2.253/kg	2,317,003
After	1,028,408 kg systems at US$ 2.37/kg	2,437,327
Total (one year)		**120,324**

Summary

Incremental Capital Costs	932,500
Contingencies (10%)	93,250
Incremental Operating Costs	120,324
Total project costs	**1,146,074**

Cost-effectiveness

Total project costs (US$)	1,145,074
ODS phased out (kg/y)	183,700
Cost-effectiveness (US$/kg/year)	**6.23**

ANNEX – 2 Overview of technology options for conversion from HCFC-141b

Following is a list of all known alternatives—validated, under validation or still under development—to replace HCFCs in rigid insulation foams. The molecular weight is mentioned as an indication of blowing efficiency and the GWP as an indication how the technology performs compared to HCFC-141b on this environmental parameter.

SUBSTANCE	GWP[1]	MOLECULAR WEIGHT	INCREMENTAL GWP[2]	COMMENTS
HCFC-141b	725	117	Baseline	
CO_2	1	44	-725	Used direct/indirect (from water)
Cyclopentane	11[3]	72	-718	Extremely flammable
HFC-245fa	1.030	134	443	
HFC-365mfc	794	148	279	
HFC-134a	1.430	102	522	
Methyl formate	negligible	60	-725	
Methylal	negligible	76	-725	Reported for co-blowing only
Acetone	negligible	58	-725	Used in flexible slabstock
FEA-1100	5	164[4]	-718	Under development
HFO-1234ze	6	114	-719	Recently introduced
HBA-2	<15	<134	-708	Under development
AFA-L1	<15	<134	-708	Under development

[1] Unless otherwise indicated, taken from IPCC's Fourth Assessment (2007)
[2] Derived from comparing GWPs compared to the baseline on an equimolar base. It should be noted that in practice formulators may make changes such as increased water or ABA blends that impact the global warming effect
[3] From UNEP Foams Technical Options Committee's 2006 report
[4] Calculated from published formulations
Green = beneficial GWP effect; red = unfavorable GWP effect

CARBON DIOXIDE -The use of carbon dioxide derived from the water/isocyanate chemical reaction is well researched. It is used as co-blowing agent in almost all PU foam applications and as sole blowing agent in many foam applications that have no or minor thermal insulation requirements. The relatively emissive nature of CO_2 in closed-cell foam is a challenge though. To avoid shrinkage, densities need to be relatively high and this has a detrimental effect on the operating costs up and above the poor insulation value. Nevertheless increased use of water/CO_2 has been, and still is, an important tool in the HCFC phase-out in cases where HCs cannot be used for economic or technical reasons. There is no technological barrier. However, the use of water/CO_2 alone will be limited to foams such as:

- Integral skin foams (with restrictions when friability is an issue)
- Open cell rigid foams
- Spray/in situ foams for non/low thermal insulation applications

Carbon dioxide can also be added directly as a physical blowing agent through the use of super-critical CO_2. This technology has not (yet) been validated and adopted in A5 projects.

HYDROCARBONS -Due to the investments needed on safety systems due to their flammability, hydrocarbons are viable for larger and more organized enterprises. In addition, the technology was deemed unsafe for a multiple of applications such as spray and in situ foams. Generally, cyclopentane has been used for refrigeration and n-pentane for panels. Fine tuning through HC blends (cyclo/iso pentane or cyclopentane/isobutane) which are now standard in non-A5 countries is not widely spread in A5's. Consequently, the investment costs are the same as at the time of phasing out CFCs and the technology will continue to be too expensive for SMEs and restricted to the same applications as before.

However, there are options to fine-tune project costs and investigate other applications with hydrocarbon technology:

- The introduction of HC blends that will allow lower densities (lower IOCs)
- Addition of methylal to decrease cell size and improve insulation value (better performance)
- Direct injection (lower investment)
- Low-pressure/direct injection (lower investment)
- Centralized pre-blending by system houses (lower investment)
- Application-specific dispensing equipment (lower investment)

HFCs -There are currently three HFCs used in foam applications. Following table includes their main physical properties:

Parameter	HFC-134a	HFC-245fa	HFC- 365mfc
Chemical Formula	CH_2FCF_3	$CF_3CH_2CHF_2$	$CF_3CH_2CF_2CH_3$
Molecular Weight	102	134	148
Boiling point (°C)	-26.2	15.3	40.2
Gas Conductivity (mWm°K at 10°C)	12.4	12.0 (20 °C)	10.6 (25 °C)
Flammable limits in Air (vol. %)	None	None	3.6-13.3
TLV or OEL (ppm)	1,000	300	Not established
GWP (100 y)	1,410	1,020	782
ODP	0	0	0

Current HFC use in A5 countries is insignificant due to high operating costs. These chemicals have, however, played a major role in the replacement of HCFCs in foam applications in non-A5 countries—despite high GWP potentials. Formulations are not straightforward molecular replacements. Generally, the use of water has been maximized and sometimes other co-blowing agents have been added. Therefore, an assessment of its environmental impact has to be based on actual and validated commercial blends.

METHYL FORMATE (ECOMATE®) -Methyl-formate, also called methyl-methanoate, is a low molecular weight chemical substance that is used recently, as a blowing agent for foams. Foam Supplies, Inc. (FSI) in Earth City, MO has pioneered its use as a blowing agent in PU foams from 2000 onwards. The application has been patented in several countries. Following data on physical properties have been reported:

Property	Methyl Formate	HCFC-141b
Appearance	Clear liquid	Clear liquid
Boiling point	31.3 °C	32 °C
LEL/UEL	5-23 %	7.6-17.7
Vapor pressure	586 mm Hg @ 25 °C	593 mm Hg @ 25 °C
Lambda, gas	10.7 mW/m.k @ 25 °C	10.0 mW/m.k @ 25 °C
Auto ignition	>450 °C	>200 °C
Specific gravity	0.982	1.24
Molecular weight	60	117
GWP	0	630
TLV (USA)	100 ppm TWA/150 ppm STEL	500 ppm TWA/500 ppm STEL

In the USA, ecomate® is not treated as a volatile organic component (not a smog generator) and is SNAP approved. In Europe it is compliant with the RoHS and WEEE directives. Acute toxicity is reported low with no special hazards. The MSDS mentions R12 (extremely flammable but not explosive); R20/22 (harmful by inhalation and if swallowed) and R36/37 (irritating to eyes and respiratory system). FSI reports a case study that shows process emissions to be lower than 100 ppm, which is less than the STEL and TWA.

METHYLAL -Methylal, also called dimethoxymethane, belongs to the acetyl family. It is a clear colorless, chloroform-like odor, flammable liquid with a relatively low boiling point. Its primary uses are as a solvent and in the manufacture of perfumes, resins, adhesives, paint strippers and protective coatings. It is soluble in three parts water and miscible with the most common organic solvents.

Property	Methylal	HCFC-141b
Appearance	Clear liquid	Clear liquid
Boiling point	42 °C	32 °C
LEL/UEL	2.2-19.9 %	7.6-17.7
Vapor pressure	400 mm Hg @ 20 °C	593 mm Hg @ 25 °C
Lambda. gas	Non available	10.0 mW/m.k @ 25 °C
Auto ignition	235 °C	>200 °C
Specific gravity	0.821 @ 20 °C	1.24
Molecular weight	76.09	117
GWP	Negligible	630
TLV (USA)	1000 ppm TWA	500 ppm TWA/500 ppm STEL

The use of Methylal as a co-blowing agent in conjunction with hydrocarbons and HFCs for rigid foam applications (domestic refrigeration, panels, pipe insulation and spray) has been described in the literature. It is claimed that in continuous panels Methylal improves the miscibility of pentane, promotes blending in the mixing head, foam uniformity, flow, adhesion to metal surfaces and insulation properties, reducing simultaneously the size of the cells. In discontinuous panels, where most producers use non-flammable agents, the addition of a low percentage of Methylal to HFCs (245fa, 365mfc or 134a) makes it possible to prepare pre-blends with polyols of low flammability with no detrimental effect on the fire performance of the foam. Methylal reduces the cost, improves the miscibility, the foam uniformity and flow and the adhesion to metal surfaces. Co-blown with HFC365mfc, it also improves the thermal insulation. In domestic refrigeration compared to cyclopentane alone Methylal increases the blowing rate and the compressive strength. In spray foam it reduces the cost of HFC-245fa or HFC-365mfc. Public knowledge of Methylal's industrial performance as blowing agent is limited

EMERGING TECHNOLOGIES -Since early 2008, several new blowing agents for PU foams have been proposed by major international manufacturers of halogenated compounds. Four of them are worth mentioning. These are all geared towards replacement of HFCs and sometimes called "second generation HFCs, although HFOs appears a more distinctive description. They have low flammability, zero ODP and insignificant GWPs:

Property	HFO-1234ze	HBA-2	FEA-1100	AFA-L1
Chemical Formula	$CHF{=}CHF_3$	n/k	n/k	n/k
Molecular Weight	114	<134	161-165	<134
Boiling point (°C)	-19	>15 <32	>25	>10 <30
Gas Conductivity (mWm°K at 10 °C)	13	n/k	10.7	10
Flammable limits in Air (vol. %)	None	None	None	None
TLV or OEL (ppm: USA)	1.000	n/k	n/k	n/k
GWP (100 y)	6	<15	5	Negligible
ODP	0	0	0	0

Except HFO-1234ze, all chemicals still have to undergo substantial toxicity testing and will therefore not soon appear in the market.

ANNEX -3 Technical Review[1]

COUNTRY OF ORIGIN: Bangladesh **PROJECT TITLE:** Conversion from HCFC-141b to cyclopentane technology in manufacturing refrigeration equipment insulation foam at Walton Hi-Tech Industries Ltd

SECTOR/SUB-SECTOR: Foams/Domestic Refrigeration insulation foam

RELATIONSHIP TO COUNTRY PROGRAMME

There is conflicting information in the project document about the market share of the enterprise in the refrigeration market in Bangladesh. The project cover sheet states that Walton is the *only manufacturer* of domestic refrigerators in the country, while the sector background indicates that Walton is the *market leader* for domestic refrigerators and includes several other brand names. The project objective includes *commercial refrigeration* equipment in the list of activities. These discrepancies should be corrected.

Response: It is not intended to address commercial refrigeration, we are deleting the reference. By sales of domestic refrigerators (including imports and locally manufactured), Walton is the market leader. It is the only local manufacturer as well. We will improve the language in the proposal.

The project document indicates that the HPMP survey is underway, which is necessary to provide complete and accurate HCFC consumption data. Figures for 2007-2009 indicate that HCFC consumption is steadily rising in the country. The currently available information shows that the majority of HCFC-141b consumption is for use as blowing agents in insulation foam for refrigeration applications. This project will phase out the majority of the HCFC-141b consumption in the country.

INTRODUCTION

This enterprise is Bangladesh's largest manufacturer of domestic refrigerators using polyurethane rigid foam insulation. The foam blowing agent is HCFC-141b and refrigerant is HFC-134a. The enterprise intends to replace the HCFC-141b in the foam manufacturing by cyclopentane. The project includes retrofit of two high pressure foam dispensers for use with cyclopentane (the other two baseline dispensers are already suitable for cyclopentane), replacement of a batch-type pre-mixer and installation of appropriate cyclopentane storage, feeding and charging equipment. Changes to mold heating systems are required for safety using flammable blowing agents. The project will entail significant changes in its manufacturing equipment and procedures.

TECHNICAL ASSESSMENT

The document body (Section 6, Justification for Selection of Alternative Technology) refers to Annex 3 for the discussion of technology and substitute options. It should be corrected to note that the information is presented in Annex 2.

Response: We will rectify the same.

There has been a thorough analysis of the pros and cons of the options to replace HCFC-141b, including CO_2 (water), HFCs and the emerging low GWP HFOs plus newly commercialized alternatives such as methyl formate.

The choice of cyclopentane for foam panel manufacturing is supported. Cyclopentane is now a very well proven blowing agent for rigid polyurethane foam and is a global industry standard for the domestic refrigerator/freezer sector. It has a low GWP and represents a long-term option.

The enterprise could also consider cyclopentane/iso-pentane blends, which can give a superior performance to cyclopentane alone. This would not affect the engineering conversion.

The enterprise currently has 4 high pressure dispensing machines and proposes retrofitting the two Hennecke dispensers for use with cyclopentane. The other two dispensers are already suitable for use with flammable blowing agents. The installation date of the baseline dispensers is prior to the cut-off date of 21 September 2007.

The project includes the generally necessary equipment changes to accommodate cyclopentane, including an above/underground cyclopentane storage tank and associated piping, replacement of a batch pre-mixer by a static mixer and buffer tank serving all dispensers, retrofit of fixtures and jigs for water heating, plant ventilation and safety equipment plus training and safety audits. The proposed changes are well described and clearly presented. It is noted that changes in the foam formulations will require a density increase.

ENVIRONMENTAL, HEALTH AND SAFETY CONSIDERATIONS

The main environmental consideration is that the technology choice is of low GWP (and zero ODP) and is a very long-term option.

There are no health considerations due to the project per se but the opportunity should be taken during the technology dissemination workshops to emphasise, particularly to small users, the importance of avoiding exposure to MDI vapour.

There are normal safety and engineering provisions included including safety audits once the conversion has been effected.

PROJECT COSTS

Per Decision 60/44 cost effectiveness thresholds for HCFC phase-out projects:

(ii) The current cost-effectiveness threshold values used for CFC phase-out projects in paragraph 32 of the final report of the 16th Meeting of the Executive Committee (UNEP/OzL.Pro/ExCom/16/20), to be measured in metric kilograms, shall be used as guidelines during the development and implementation of the first stage of HPMPs;

also

(iv) Funding of up to a maximum of 25 per cent above the cost effectiveness threshold will be provided for projects when needed for the introduction of low global warming potential (GWP) alternatives.

Therefore, the cost effectiveness threshold for rigid foam is calculated as US$7.83/kg ODP x 1.25 = US$9.7875/kg ODP. However, due to the classification of Bangladesh as a low ODS consuming country, no threshold is applicable. The project document indicates 100% local ownership, and the requested grant reflects the ownership.

The cost effectiveness calculated for the project is US$8.58/kg HCFC-141b phased out. However, the document goes on to state that this reflects the net ODP value of the CFC's phased out of 183.7 tons. This is inaccurate as the ODP of HCFC-141b is 0.11, resulting in ODP reduction of 183.7 x 0.11 = 20.207 ODP tons, with a resulting cost effectiveness of US$0.94/kg ODP phased out. The US$8.58 reflects the cost effectiveness per kg ODS phased out.

Response: Noted. We will revise the language in the document to reflect the ODS and ODP phase-out accurately.

Incremental Capital Costs:

The capital costs are based on retrofit costs of $80,000 per dispenser for the two baseline dispensers. The costs proposed appear reasonable. The costs for the storage and handling, pentane blending and pumping operations, jig and fixture retrofit as well as the safety related investments appear reasonable.

It is noted that one additional door fixture is to be added, though it is unclear why the addition of one fixture is necessary due to the conversion. Please provide additional justification for the inclusion of an additional door fixture as a related conversion cost. The incremental capital cost table should indicate what portion of each category is safety related costs.

Response: This reflects the precedent for evaluating and recommending eligible components in domestic refrigerator conversions, based on agreement reached between Secretariat and agencies, on jigs and fixture related costs. Out the total number of jigs, it was agreed that the cost of replacement of one jig would be eligible and the remaining would be eligible for retrofitting costs. We will show the safety related costs separately.

Incremental Operating Costs:

The incremental operating costs should be recalculated according to the terms of ExCom Decision 60/44 which states:

"HCFC phase-out in the foam sector
(v) Incremental operating costs for projects in the foam sector will be considered at US $1.60/metric kg for HCFC-141b".

This will simplify the incremental operating cost calculation, and result in slightly higher incremental operating costs than currently requested.

Response: It appears that the incremental operating costs need to be justified and the actual costs or US$ 1.60/kg-ODS, whichever lower, would be eligible. We will seek a clarification on this from the Secretariat.

IMPLEMENTATION TIMEFRAME

The proposed implementation timeframe of 24 months seems a bit optimistic. Most hydrocarbon conversion projects have a 30-or 36-month timeframe. Is there a specific reason for the shorter timeframe on this project?

Response: The enterprise has already initiated preparation for the conversion and wishes to fast-track implementation. It is a well-organized enterprise and completion of this project by 2013 will help ensure Bangladesh's compliance with the 2013 freeze.

RECOMMENDATIONS

Approval after modification as indicated in the review.

Mary E. Courtney UNDP Foam Sector Reviewer 10/2/2010

The comments given in this annex relate to technical review process that was completed by UNDP prior to submission of the project for the consideration of the Executive Committee and negotiations with the Secretariat on final project costs (i.e., negotiations for the consideration of the project in the 62nd Meeting of the Executive Committee). The comments given by the technical reviewer were suitably addressed by UNDP (as given in the responses). After this, the project was submitted for the consideration of the Executive Committee in its 62nd Meeting and approved by the 62nd Meeting of the Executive Committee at USD 1,146,074 for phasing-out 20.2 ODP tons.

Annex-5 Terms of Reference

Walton Hi-Tech Industries Limited will phase out the usage of HCFC-141b as a blowing agent for the polyurethane foam insulation in its manufacturing of refrigeration equipment by converting to cyclopentane technology. In order to achieve this, Walton Hi-Tech Industries Ltd. shall carry out the following activities and any other actions not necessarily limited to those mentioned below:

1. Cyclopentane storage, delivery and handling system for cyclopentane, comprising of under/above ground carbon steel storage tank of 60 m^3 capacity, two delivery pumps (one working and one standby) with electric drive motors of explosion proof rating and the necessary piping, valves and fittings including gas return and pressure relief lines, for transferring cyclopentane from the storage tank to the pre-mixing unit.

2. One pre-mixing station comprising of a static mixer, a jacketted buffer tank, metering/recirculating pumps for the components and chemical loading pumps, that incorporate the safety requirements for cyclopentane.

3. Replacement of the existing inter-connecting high pressure piping and fittings for transfer of the chemicals, between the pre-mixing unit, foam dispensers and the mixing heads, with those suited for handling cyclopentane and meeting the requirements of the new layout.

4. Retrofitting/modification and/or replacement, of the existing four foam dispensers to enable operation with cyclopentane, including all safety requirements

5. Retrofitting/modification and/or replacement of the heating systems of the existing cabinet and door foaming fixtures to enable operation with cyclopentane, including all safety requirements

6. Introduction of a water conditioning system, to provide heating and cooling for the cabinet and door foaming fixtures, and also for the temperature control of chemicals, comprising of a water heater, chilling unit, interconnecting piping, valves and fittings, expansion tank(s), insulation, controls and instrumentations

7. A ventilation and exhaust system for maintaining safe concentrations of cyclopentane in air comprising of sheet metal ducting and blowers/fans for supply air as well as for exhaust of air extracted from the all vulnerable locations such as premixing unit area and foaming areas.

8. A safety system for detection and monitoring of hydrocarbon concentrations and for prevention of fire and explosion hazards comprising of hydrocarbon sensors/detectors at assorted locations, alarm, and control system, water sprinkler system for fire extinguishing covering the vulnerable areas, portable fire-extinguishers for areas unsegregated from the vulnerable areas, a nitrogen system for mold flushing to prevent static electricity generation and anti-static flooring for vulnerable areas

9. Electrical works for the conversion complying with safety regulations pertaining to areas handling flammable/explosive substances comprising of main control panel and local distribution panels for the new electrical equipment, power and control cabling, grounding and terminations, control and interlocking wiring for the safety systems and a back-up AC electric power generator covering the requirements of the ventilation, fire extinguishing, alarm and nitrogen systems.

10. Civil and miscellaneous works comprising of excavation and refilling for the underground cyclo-pentane storage tank, foundations and housing for all new equipment, civil works for pipe/duct/cable support installation, making and refinishing wall/floor openings, floor finishing, relocation of existing foam dispensers and other equipment, supports/foundations for installation of new equipment, etc.

11. Trials for validation of new formulations, process and equipment covering the cost of chemicals, raw materials/consumables and utilities required during commissioning.

12. Training and reorientation of production personnel to be able to work with the new formulations and process and for establishing safe practices in handling flammable/explosive substances

13. Milestones, Indicators and Payments

No	Milestone	Indicator	Amount (US$)
1	Finalization of plant layout, product redesign and implementation plan	Plant layout drawings, specifications of products with non-HCFC technology and implementation schedule	150,000
2	Retrofitting/modifications of existing foam dispensers and foaming fixtures	Visual inspection at site	240,000
3	New equipment and systems, such as cyclopentane storage and handling system, premixing station and water conditioning system	Visual inspection at site	450,000
4	Installation, trials, commissioning and safety audit	Visual inspection at site and receipt of satisfactory report of safety audit	100,000
5	Phase-out of HCFC-141b in the manufacturing operation	Visual inspection at site and signing of handover protocol	72,824
			1,012,824

MEMORANDUM OF AGREEMENT
Walton Project

This Memorandum of Agreement (hereinafter referred to as the "Agreement") made this on [---------], among Ministry of Environment and Forests (hereinafter referred to as "MOEF"), Department of Environment, Montreal Protocol Unit (hereinafter referred to as "DOE") and Walton Hi-Tech Industries Limited (hereinafter referred to as the "Recipient") for phase-out of HCFC-141b technology and converting to cyclopentane-based technology in the manufacture of refrigeration equipment;

WHEREAS the technology conversion proposal for the Recipient was approved by the Executive Committee of the Multilateral Fund to the Montreal Protocol in its 62nd Meeting held in December 2010;

WHEREAS the Recipient agrees to phase out the use of HCFC-141b and convert to cyclopentane as the blowing agent in the insulation foam in manufacture of refrigeration equipment;

WHEREAS the conversion proposal submitted by recipient has been reviewed by DOE with assistance of technical experts from the United Nations Development Programme (UNDP) and that MOEF accepts the recommendations of the said review;

NOW, therefore, the Parties hereto agree as follows:

1. Responsibilities of Recipient:

1.1 Recipient agrees to carry out activities as described in the Terms of Reference in Annex-A (hereinafter referred to as "Activities"), which form an integral part of this Agreement.

1.2 None of the funds provided pursuant to this Agreement may be used any purpose other than those expressly set forth in Annex-A.

1.3 Unless specifically mentioned otherwise, Activities shall be deemed to be inclusive of design, engineering, assembly, fabrication, supply, installation, start-up, trial runs and commissioning, and all materials, labor, consumables, etc.

1.4 Recipient shall bear any costs required for successful conversion to fully HCFC-free technology over and above the approved funds as described in 3.1 below.

1.5 Recipient shall permanently discontinue the use of HCFCs on or before **31 December 2012** and dispose all redundant baseline equipment that may been replaced under the scope of this Agreement and allow monitoring inspections by MOEF, UNDP, DOE, or their designated representatives during project implementation and after project completion, to verify the same.

1.6 Recipient undertakes to obtain all regulatory and other approvals that may be required for carrying out the Activities at their own cost and in accordance with the prevailing laws.

1.7 Recipient undertakes to obtain all regulatory and other approvals that may be required for carrying out all activities in accordance with the prevailing laws.

1.8 Activities shall be carried out at the following location:

Walton Hi Tech Industries Ltd
Holding No. 1-25/1, Ward No. 07,

Chandra, Kaliakoir,

Gazipur, Bangladesh

2. Duration

2.1 This Agreement will come into effect on (--------) and shall be effective until 31 December 2012.

2.2 The duration of the agreement may be extended at the discretion of DOE.

3. Compensation

3.1 As full consideration for the activities carried out by the Recipient, Recipient shall be paid a total amount of US Dollars 1,012,824 (US Dollars One Million Twelve Thousand Eight Hundred and Twenty Four only) in accordance with the milestones, indicators and amounts set forth in Annex-B.

3.2 All payments shall be made in equivalent local currency based on applicable UN exchange rates.

3.3 The payment amounts are not subject to any adjustment or revision because of price or currency fluctuations or the actual costs incurred by the Recipient in the performance of the Agreement.

4. Records, Information and Reports

4.1 Recipient shall maintain clear, accurate and complete records in respect of the funds received under this Agreement, in such a manner that the receipts and expenditures of the funds will be shown separately on such books and records and can be easily checked.

4.2 Recipient shall furnish, compile and make available at all times to DOE, any records or information, oral or written, which DOE may reasonably request in respect of the services performed by the Recipient.

4.3 Recipient shall provide to DOE, a report containing the status of progress of implementation of Activities and status of expenditures undertaken, every two months.

5. General Provisions

5.1 This Agreement and the Annexes attached hereto shall form the entire Agreement between Recipient, MOEF and DOE, superseding the contents of any other negotiations and/or agreements, whether oral or in writing, pertaining to the subject of this Agreement.

5.2 Recipient shall carry out all activities under this Agreement with due diligence and efficiency.

5.3 DOE undertakes no responsibilities in respect of life, health, accident, travel or any other insurance coverage for any person, which may be necessary or desirable for the purpose of this Agreement or for any personnel performing services under this Agreement. Such responsibilities shall be borne by the Recipient.

5.4 The rights and obligations of the Recipient are limited to the terms and conditions of this Agreement. Accordingly, the Recipient and personnel performing services on its behalf shall not be entitled to any benefit, payment, compensation or entitlement except as expressly provided in this Agreement.

5.5 The Recipient shall be solely liable for claims by third parties arising from the Recipient's acts or omissions in the course of performing this Agreement and under no circumstances shall DOE, MOEF or UNDP be held liable for such claims by third parties.

5.6 Equipment purchased by the Recipient with funds provided under this Agreement shall be used for the purpose indicated in the Agreement throughout the period of this Agreement.

5.7 No modification of or change in this Agreement, waiver of any of its provisions or additional contractual provisions shall be valid or enforceable unless previously approved in writing by the parties to this Agreement or their duly authorized representatives in the form of an amendment to this Agreement duly signed by the parties hereto.

5.8 Any controversy or claim arising out of, or in accordance with this Agreement or any breach thereof, shall unless it is settled by direct negotiation, be settled in accordance with the Bangladesh Arbitration Act and rules therein as at present in force. Where, in the course of such direct negotiation referred to above, the parties wish to seek an amicable settlement of such dispute, controversy or claim by conciliation, the conciliation shall take place in accordance with the provisions of the Bangladesh Arbitration Act and rules therein as at present in force. The parties shall be bound by any arbitration award rendered as a result of such arbitration, as the final adjudication of any such controversy or claim.

5.9 Nothing in or relating to this Agreement shall be deemed a waiver of any privileges and immunities of the DOE, MOEF and UNDP.

IN WITNESS WHEREOF, the undersigned, duly appointed representatives of Recipient, and DOE respectively, have signed the present Memorandum of Agreement on the dates indicated below with their respective signatures.

On behalf of Recipient:	**On Behalf of Ministry of Environment and Forests:**	**On behalf of DOE:**
Managing Director/Corporate Secretary	**Secretary**	**Director General**
Walton Hi-Tech Industries Limited	Ministry of Environment and Forests	Department of Environment
Date:	Date:	Date:

Annex-7 (M&E Plan)

Monitoring and Evaluation Plan (Dates Should be effective from the day of GOB approval and NPD in Place).

Main Outcome	Main Activity	Sub Activities	
Recruitment of Consultants	Recruitment of International Consultants	Preparation of TOR	
		Consultant on Board	
	Recruitment of Local Consultant for Safety Audit	Preparation of TOR	
		Consultant on Board	
Implementation Plan	Finalization of Workplan	AWP Preparation and approval from UNDP & Government	
	Finalization of Plant layout and product redesign	Plant Layout drawings.	
		Specification of products with cyclopentane technology	
	Implementation plan	Implementation Schedule	
Site preparation	Civil works	Civil work for Cyclopentane Storage and handling system	
	Electrical & Sanitation	Installation of Electrical and sanitation system.	
	Water conditioning	Installation of Water Conditioning Plant	
Retrofit / modification of Existing system	Procurement of Equipment	Installation of new equipment	
		Trial production	
		Safety audit	
Commissioning	Production of cyclopentane based foam	Commercial batch production	
Project Closure	Project Closure	Project operationally closed	
		Project financially closed	
		Submit PCR to MLF	
		End	