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PROJECT PROPOSAL FOR THE MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL FINANCING

16p. tables

COUNTRY	: INDIA	
PROJECT TITLE	: Conversion of ODS Cleaning and Coating Processes from CFC- 113, Carbon tetrachloride and Trichloroethylene to IPA and Xylene at Vidyut Metallic Ltd., Thane.	
SECTIONS COVERED	: Solvents	
ODS USE IN SECTOR	: 4876 MT (ODP-weighted) of ODS solvents in 1991.	
PROJECT IMPACT	: Phase out annual consumption of 20MT of CFC-113, 2 MT of CTC (total 18.24 ODP-weighted MT)	
PROJECT DURATION	: 18 Months	
PROJECT ECONOMIC LIFE	: 10 years	
TOTAL PROJECT COST	: Investment (Capital Cost)	US$ 472,250
	Incremental operating savings	US$ 44,485
	Total Project cost	US$ 427,765
OWNERSHIP STRUCTURE	: 100% Indian	
PROJECT MF FINANCING	: US$ 427,765	
UNIT ABATEMENT COST	: US$ 3.44 per ODP kg. Of phased out ODS	
CURRENCY CONVERSION	: US$ 1.00 = Indian Rs.40.00	
COUNTRYPART ENTERPRISE	: Vidyut Metallics Limited, Thane, Mumbai	
IMPLEMENTING AGENCY	: UNIDO	
NATIONAL CO-ORDINATING AGENCY	: Ministry of Environment and Forests	

PROJECT SUMMARY

The main requirement of this project is to phase out the use of CFC-113 and Carbon tetrachloride at Vidyut Metallics Ltd, Bombay-Agra Road, Thane. These solvents were used for the following applications :

1. Blade Cleaning Process : This process is used for cleaning for razor blade, which comes out of the grinding and polishing operation. While polishing operation, we are using polishing paste on felt and lot of particles are found stuck on the edge of the blade which should be cleaned with a proper cleaning solvent before doing any polymer coating. This cleaning process was done by dipping blades into the special chamber containing proper cleaning solvent.

2. Blade Edge Coating : After cleaning the blade, the edge is coated before performance. This coating is done by the chemical called Vydax (brand name) in CFC-113, there are lot of other accessories required for cleaning and spraying this equipment, such as Spray gun, Static charger, Blade Carrier, Mixing tank, and other fire preventive equipment. The details of cost and capacity are explained in this report.

3. Circuit Card cleaning : The various machines used in the manufacture of blades, for regular maintenance of the machines the electronic circuit cards are cleaned using carbon tetrachloride.

CHAPTER - I

1. PROJECT OBJECTIVE

The main objective of this project is to phase out the use of ODS (CFC-113 Carbontetrachloride and other solvents) in the blade manufacturing process. At Vidyut Metallics Ltd., Thane, Ozone Depleting substances are used in blade manufacturing processes, which require phase out of ODS with non-ODS solvents. The two processes where ODSs are used are (I) blade edge cleaning and (ii) Polymer spray coating on the blade edges. ODS solvents. These two processes are blade cleaning and Polymer Spray coating. This project is one of the major projects formulated for this solvent based ultrasonic cleaning and electrostatic coating area. It is first of its kind in India and has special objective

With reference to blade manufacturing process, it is very much essential to phase out stage wise, the use of ODSs in the blade cleaning process and in blade edge coating process. The Ministry of Environment and Forest, New Delhi is expected to Identify and help to increase the awareness in metal Industries for phasing out ODS in the cleaning process. The main activity is collecting and compiling the technical information and to provide technical support for the various problems related to phasing out ODS solvent in blade manufacturing process. The support includes Material testing, Process testing, process development,Cost effectiveness analysis and selecting the technical specifications for the best equipment to be used for this project. This project can also give guidelines to other Private companies involved in the production of razor blades and other metal industries where metal cleaning or metal coating is part of its process.

CHAPTER - II

SECTOR BACKGROUND

India became a signatory to Montreal Protocol in 1992 and as a part of subsequent exercise, a Country Programme document was prepared by the Government with the assistance of UNDP. This document has assessed the Ozone Depleting Substances (ODS) consumption in the country and on the basis of this, a National Programme for the Phase-out of ODSs has been prepared to ensure the Phase-out of ODSs according to the national development strategy, without undue burden to consumers and industry.

2.2 The solvents sector is the largest user of ozone depleting substances (ODS) in India. The size of consumption has been investigated in a number of studies. According to India Country Programme : August 1992, the total consumption of ODS in the country by 1991 was 10,370 tonnes equivalent to 13,111 tonnes ODP. Out of which, the solvent sector consumed 100 MT of CFC-12, 300 MT of CFC-113, 4,000 MT of carbontetrachloride and 550 MT of 1,1,1-trichloroethane (MCF), i.e. a total of 4,876 MT of ODP (ozone depletion potential)-weighted consumption, that is 36.6 per cent of total ODP-weighted consumption in India.

2.3 ODS consumption in the solvents industry is split between electronics, metal cleaning and other processes such as textiles, pharmaceuticals, pesticides, chlorinated rubber, etc. Cleaning processes used in the electronics industry consumed in 1991, 150 MT CFC-113, 75 MT CTC and 30 MT of MFC and included flux removal (printed circuit cards and hybrid circuits), semi-conductor manufacturing, microelectronics component cleaning, metal and plastic part cleaning and photoresist development and stripping. The use of ODSs in electronics cleaning in India has been increasing as a result of the development of the electronics industry.

2.4 ODS consumption in India : As per the India Country Programme, the ODS & ODP figures for the year 1991 and unconstrained scenario by 2010 is given in the following Table-1, Exhibit-1

Table-1

1991 Consumption

Types of ODS	All Sectors			Solvents		
	Actual MT	ODP Weighted MT	%	Actual MT	ODP Weighted MT	%
CFC-11	900	1900	14.4	0	0	0.0
CFC-12	2850	2850	21.6	100	100	2.1
CFC-113	320	342	2.6	300	321	6.6
Sub-total	5070	5092	38.6	400	421	9.7
Halon-1211	550	1650	12.5	0	0	0.0
Halon-1301	200	2000	15.1	0	0	0.0
Sub-total	750	3650	27.6	0	0	0.0
CTC	4000	4400	33.3	4000	4400	90.2
MCF	550	66	0.5	550	55	1.1
TOTAL	10370	13208	100.0	4950	876	100.0

]Sectoral Distribution

Aerosols	1100	1100	8.3
Forams	1580	1580	12.0
Refrigeration	1990	1990	15.1
Solvents	4950	4876	36.9
Halons	750	3662	27.7
TOTAL	10370	13208	100.0

The total ODS consumption as solvent in India in 1991 is given at Table-2

Table-2

ODS Consumption in Solvent Sector

Sub-Sector	ODS	Qty.	ODP
Electronics	CFC-113	150	120
	CTC	80	8 8
	MCF	30	3
Textile Cleaning	CTC	600	660
Pharmaceuticals	CTC	1060	1160
Pesticides	CTC	800	880
Rubber industry	CTC	320	352
Chemicals & Laboratory	CTC	70	77
	MCF	50	5
Sterlization	CFC-113	10	8
	CFC-12	100	100
Metal & precision cleaning	CFC-113	130	104
	MCF	40	4
Miscellaneous uses	CFC-113	10	8
	CTC	1070	1177
	MCF	430	43
Sub total	CFC-12	100	100
	CFC-113	300	240
	CTC	4000	4400
	MCF	550	55

2.5 Subsequently to the finalisation of India Country Programme for ozone depleting phase out under Montreal Protocol rtment of Electronics (DoE) / Electronics Technology Development & Trade (ET&T) has formulated a programme under which a few solvent phase out proposals can be worked out. ET&T is a commercial venture by DoE and involved in the manufacturing of electronics components & products and has got expertise and infrastructure to carry out such programmes in an efficient manner. and taking into consideration the structure and distribution of Indian Electronics Industry and lack of awareness, UNIDO in co-operation with Department of Electronics/ Centre for Materials for Electronics Technology formulated a programme under which 04 OD solvent phase out projects were worked out which have been approved by multilateral Fund for financial assistance. As a follow up to this programme, UNIDO in co-operation with Department of Electronics / Electronics Trade & Technology Development (ET&T) are currently working on the preparation of five projects for ODS phase out by Industry under the guidance of UNIDO.

CHAPTER III

ENTERPRISE BACKGROUND :

Vidyut Metallics Ltd. was incorporated in 1953 with the name PANAMA Blade Pvt. Ltd. as a Group Company of Malhotra Group. Subsequently the name of the company was changed to Vidyut Metallics Ltd. having its registered office at Malhotra House, Mumbai. The company became a deemed Public Ltd. Company under Section 43 A of Companies Act, 1963.

3.2 Vidyut Metallics Ltd. (VML), is the second largest manufacturers of safety razor blades in the world with sophisticated facilities for manufacture of tools, blade manufacturing machines and processing of steels for blade making.

3.3 VML is the first company in India to introduce stainless steel blade and twin blades. In a short span of 10 years, VML has achieved tremendous growth. Its turn over has short up to Rs.198 crores in 1996-97 from a meagre figure of Rs.11 crores in the year 1985-86. This has been made possible by hard work of committed team of professional managers. The Vidyut Group controls 70% of the total Indian blade market, out of which 60% (42% of total) is contributed by Vidyut Metallics, Thane Unit. The progress of the group in recent years has been achieved and sustained through two basic strength, firstly the company developed a strong research and development set up to keep pace with technological innovations taking place in advance countries and incorporating them in the products as well as the manufacturing processes continuously in the above unit. Secondly, the effective technology acquisition on a continuous basis, the company took assistance of International Experts as well as leading organisations in the field of Electronics, Machine tools, Computers, Mould Making, Steel Manufacturing, etc. Today the company has got sophisticated blade manufacturing activity including backward integration as given below :-

a. **Machine Building: Razor** blade machines require a high degree of precision and consistency of individual component in order to maintain the highest quality standard. The organisation started its own in-house machine building activity in 1958 and thereafter developed all the necessary technical know-how for machine building and manufacturing technology for razor blades. The machines built are of international standards with fully microprocessor control at reasonably lower prices than international market. This enables VML to compete in the local and international market. Today VML has advanced technology developed indigenously through in-house R&D for the following :-

i. Razor Blades Manufacturing Machines.
ii. Tools required for Razor Blade manufacturing
iii. Moulds for razor & cartridge manufacturing
iv. Cold rolling of steel strip

b. **Tool Room:** VML has set up one of the most sophisticated and ultramodern tool room facility. The tool room is equipped with CNC sparks erosion machines and optical profile grinders, besides the conventional high precision machinery.

c. **Cold Rolling of Steel Strips** : VML has full-fledged manufacturing facility of cold rolled strips suitable for blade making. Most of the requirement of steel strips is met from in house production. However, a small percentage of about (20-30%) is met through imports.

d. **Razor Blade Manufacturing :** VML has advanced manufacturing facility for razor blades and twin track shaving systems. The fast moving items include (a) Sensor Moving Blade Cartidge (b) Lubra Strip Products (c) Disposable (d) Double edge stainless steel (e) Double edge carbon steel.

3.4 The company has achieved multiple growth in production, sale and exports during the last decade. The details with regard to the production , sale and export during the last five years is as follows :-

Production in Million Pieces
Turn over and Export in Rs. Millions

Year	1993-94	1994-95	1995-96	1996-97	1997-98
Production	1300 .00	1600 .00	1880 .00	2060 .00	2220.00
Turn Over	729.00	1077.34	1216.55	1582.20	1985.62
Export	108.62	218.51	365.53	540.97	614.79

3.5 Vidyut Metallics has invested about Rs.2040 millions in fixed assets during the last five years in addition to the original investment at the time of incorporating the company in establishing razor blade manufacturing and other activities highlighted above. It has a total manpower of 2200 for running the plant on three-shift basis. The installed capacity of the plant is 2200 million blade per year.

Blade Cleaning Process (ultrasonic Cleaning)

3.6 In razor blade process, cleaning is very much essential after edge sharpening and polishing operation. During sharpening and polishing operation, the dirt or the polishing compound or any other foreign particles which are stuck on the blade edge should be cleaned thoroughly without damaging the blade edge before sending it for further process of polymer coating. This was done by wet cleaning process. The wet cleaning in VML is done by 'Ultrasonic Cleaning' process. The equipment was brought in 1978 from 'Imecoilli, U.K.

3.7 Ultrasonic wet cleaning process is done through various methods. The Piezo Electric Transducers are immersed into the solvent CFC-113 into the tank. High frequency generator converts the main frequency into Ultrasonic frequency which in turn is converted into mechanical energy in the form of vibrating waves by Piezo electric, due to this the solvent will get the compression and agitation which forms microscopic bubbles inside the liquid, causing increase in temperature and pressure. This phenomenon is known as cavitation and this results thorough cleaning of edge of blades. The cleaning process is described below.

i. The blade stacker is dipped into the CFC-113 Freon solvent and Ultrasonic waves are passed. During this process rough cleaning is done and all foreign particles will get loosened in this process. The total time required is 5-8 minutes.

ii. After rough cleaning the blade stacker is placed in vapour degreasing chamber where all the fine particles are cleaned with vapours of CFC-113.

iii. Final cleaning is done in clean solvent of CFC-113. All remaining foreign particles are cleaned thoroughly by ultrasonic operation in this stage, so that the blade can be sent for polymer coating after this operation.

3.8 VML has modified this process so that all above 3 operations were performed in one tank only.

Blade Edge Coating Process

3.9 Till 1994 VML was using Vydax-1000 polymer for coating the razor blade edges. Vydax is a brand name of Dupont, USA. It is Poly Tetra Fluoro Ethylene (PTFE) mixed with CFC-113 (Freon TF) in the form of five colloidal suspension. This concentrated suspension containing around 7.5% of PTFE polymer in CFC-113 by weight. For razor blade coating this concentrated solution should be diluted in required ratio to get fine uniform solution containing around 1 to 2% of the solute. For this purpose, Vydax-1000 & CFC-113 were mixed in 1: 9 proportion in a mixer (mixing tank with integral pump, stirrer mechanism) later it is homogenized in a homogeniser with pressure of 8000 lbs/sq.inch. In this process the polymer particle size is uniformly reduced from 30 microns to 1 micron, which results uniform and fine spray during spray operation. This fine solution is sprayed through electrostatic spray gun. The complete operation is done in spray booth where blade carriers are moving horizontally on conveyor. Spray gun is activated by Limit switches for proper timing and position. The total annual consumption of CFC-113 for coating was 20.05 MT including 2 MT required for system cleaning.

3.10 The ODS consumption in the cleaning and coating processes at VML was as follows.

Process	ODS	Consumption		
		per day (Kg)	Before 1992 per year (MT)	After 1992 per year (MT)
Cleaning				
Blade Cleaning	CFC-113	160.00	57.28	--
System Cleaning	CFC-113	5.00	1.79	--
Sub Total		165.00	59.07	--

Coating				
Blade edge coating	vydax-1000	2.32	0.83	1.96
Solvent for dilution	CFC-113	20.11	7.20	17.9
System cleaning for Homogeniser and spray guns	CFC-113	3.0	1.07	2.15
Subtotal (CFC-113)		**23.11**	**8.27**	**20.05**
Blade Carrier Cleaning	Trichloro-Ethylene	20.00	7.16	7.16
Circuit Board Cleaning	Carbon-Tetrachloride	04.4	1.6	2.0

3.11 The list of equipment used for ODS based cleaning and coating at VML unit alongwith broad specifications and purchase price are indicated below.

O.D.S. Equipments at Vidyut Metallics Ltd.,

	List of Equipments	Qty.	Price Rs. (Lacs)
1	Ultrasonic degreaser with solvent tank *	2 Nos	1.5
	1. Blade carrier	2 Nos.	0.2
	2. Blade charger	300 Nos.	1.5
2.	Blade Edge coating, Spray system	2 sets	
	1. Spray guns	2 Pairs	3.0
	2. Blade carrier	2 Nos	0.2
	3. Blade carrier motor drive system with limit switches and voltage regulator	2 Nos.	2.0
	4. Solution circulating pump 1/2 HP.	2 Nos.	1.0
	5. Solution container with stirrer & speed control	2 Nos.	0.8
	6. Exhaust system for Vydax fumes	1 No.	1.0
3	Ancillary		
	1. Controlled environmental chamber with Thermostat control and humidity	1 No.	1.5
	2. Homogeniser for Vydax	1 No.	2.0
	3. Polymer mixing pump 1/2 HP. Motor with input and output pipeline.	1 No.	0.5
	4. Hot chamber with temperature control	1 No.	0.5

* **Equipment removed & scrapped**

3.12 The year wise break up of ODS substances in the production at VML Thane was as under:

(Figures in Tonnes)

Solvent	Before 1992	1992-93	1994-95	1995-96	1996-97
CFC-113	8.7	8.7	14.9	20.05	8.9
CTC	1.60	1.60	1.60	1.60	2.00

CHAPTER - IV

PROJECT DESCRIPTION:

Sector wise approach :

4.1 This technology has been developed by the team of Engineers of Vidyut Metallics in house and it requires different equipment as shown above. The main heat-cleaning furnace can be imported or can be made local manufacturers by getting the design for setting up the pilot plan and commercial unit. This furnace is having high electrical power consumption but at the same time there is no solvent or ozone depleting substances are used in this process. This process is a proven technology and very much successful all over the world and will give the best quality product up to international standards.

TECHNOLOGICAL SELECTION, EQUIPMENT SELECTION FOR CLEANING & COATING SYSTEM

4.2 Vidyut Metallics Ltd. have a very good team of Engineers towards the research & development of new processes, technologies and machines. They have put in considerable amount of efforts to develop suitable ODS free processes, technologies to change over from presently used ODS system to non-ODS system. It was found that the other chlorinated solvent, aqueous and semi-aqueous cleaning and cleaning with petroleum solvents, ketones and alcohol and heat cleaning were found to be acceptable as the new alternative technology to phase out the utilisation of ODSs cleaning processes.

BLADE EDGE CLEANING PROCESS AT VIDYUT METALLICS LIMITED, THANE

4.3 Blade manufacturing process starts from perforation / punching and ends at the packaging. The blade strip passes through various operations such as heat treatment, passivation, printing, grinding and polishing. After polishing operation blade edge must be cleaned before it goes for polymer spray. While cleaning the blade edge all the foreign particles must be removed and the edge must be free from oil or greace or any foreign particles. For cleaning the blade edge air or water will not be suitable and other solvents are very expensive. The batch cleaning equipment manufacturer is specifying the cleaning and drawing cycle upto 30 minutes. During the cleaning process the blades are stacked into the bayonets and the whole blade carrier is dipped into the cleaning solvent tank. During the cleaning process the temperature drops from 80°C to 40°C and the cleaning time is 30 minutes. At Vidyut Metallics Ltd., production capacity is 2200 millions blades per year. To complete the production requirement per day total 4 machines were used in the begining to produce 60 lacs blades per day in 2 shifts. One blade charge contains 45000 to 48000 blades in a blade carrier and the cycle time is 30 minutes.

ALTERNATE BLADE CLEAING SYSTEM

4.4 The alternate method to above cleaning process is to clean the blade edge by means of heating the edge so that the waxes and other foreign particles which are stuck on the edge will get evaporated and the blade edge becomes clean and free from foreign particles.This process is very much proved all over the world, however the team of R & D Engineers in VML has done lot of efforts for the development of this process and the successful trial has been carried out by the technical team. The main features of this process are as follows.

- The blade edge cleaning is done by heating at 350°C and evacuating.
- Heating and cooling is done by rapid method in Hydrogen or Cracked ammonia atmosphere.
- Special heating panel and insulating panel are designed to get uniformity in the process.
- The strong chamber and lid is designed such that it can withstand Hydrogen explosion within the chamber without damaging any other auxiliary equipment.
- Specially designed vacuum evacuating chamber to avoid any danger of insulation material mixing with the product or goes into the vacuum pump. The heating chamber filled with cracked ammonia atmosphere which keep the blade oxide free.
- Nitrogen gas is purged while loading and unloading operation to avoid any explosion due to entering of air inside the chamber while cracked ammonia is already inside.

Technical specifications of Heat cleaning furnace

4.5 The technical specifications of Heat cleaning furnace is given below.

1. Type of Furnace	: Twin chamber vacuum purge.
2. Temperature	: 450°C
3. Blade carrier	: Specially designed blade carrier contains approx. 1 lac blade pushed into the heating chamber for heating & soaking.
4. Cycle time	: 20 - 25 min. Depending on the No. Of blades.
5. Heating and Cooling	: Heating plates and cooling plates are provided in heating and cooling chamber respectively. Each gives required temperature at heating and cooling stage.
6. Temperature controls	: Heating element gives the necessary temperature to the blades. The control is made through microprocessor based PID controller.
7. Atmosphere	: Both the chambers are operated in cracked ammonia chamber which keeps the blades oxide free, however Nitrogen is purged while loading and unloading to avoid the explosion during the process.
8. Safety	: The furnace is provided with various safety interlocks and strong steel explosion relief lid is provided for emergency.
9. Carrier drive	: A set of driven rollers are provided to move charge carrier.
10. Entry and exit	: A special conveyor is provided with drive rollers at entry and exit for loading and unloading of blade carriers.
11. Pneumatics	: Pneumatic valves and actuators are provided at all the doors and lids of the furnace along with the safety interlock valves for and cracked ammonia Supply.

4.6. Heat cleaning is the most favourable method of cleaning the razor blades in the present day context. A twin chamber vacuum purged furnace can be used for the purpose. To use this furnace specially design blade carrier (blade stacker) is required. To carry the blades inside the furnace. Various other accessories are also required to complete the production cycle and required capacity.

1. Handling conveyors at entry and exit end.
2. Ammonia cracker for cracking hydrogen and nitrogen.
3. Nitrogen generator which is required for flushing the charge to avoid explosion.
4. Chilling plant for furnace cooling.

4.7. Continuous heat cleaning systems is a conveyorised system for carrying the blades for cleaning operation. Ammonia crackers are required to crack ammonia into hydrogen and Nitrogen. Hydrogen is burnt whereas Nitrogen is used as a protective atmosphere during operation which protect the blade for oxidation during heat cleaning. This alternate technology has been developed by VML in-house and the required equipment, heat cleaning furnaces and part of the accessories have been imported and installed. Some of the machine parts and accessories made fabricated locally. The unit has set in operation and working smoothly. However, the unit set up can cater a production capacity of 4 million blades per day as against the total production capacity of 7.0 million blades per day. The technology is power intensive but no solvent or ODS are used in this process. This cleaning process has been proved to be very successful. In order to use the alternate heat cleaning process for the entire production, an additional heat cleaning furnace with all accessories as described above need to be set up. VML has already phased out completely the use of ODSs in Blade Cleaning Process. As described approximately 60% of the production is based on conveyorised heat cleaning system. However, the remaining 40% of the production is. achieved through low tech, manually operated furnaces where the electrical power consumption is exorbitant and not cost effective. This heat cleaning process has been proved to be very successful as it has resulted into the product quality to international standards. The new heat cleaning system would cost US $ 3,25,000 which would take care of the cleaning of remaining production.

ALTERNATIVE PROCESS OF BLADE COATING

4.8. The alternative technology which has now been adopted by major razor blade manufactures is to use Vydax 2000/IPA which is a 20 percent dispersion of fluorotelometer solids in ISO-propyl alcohol (IPA), which is then diluted to the required coating concentrations with IPA. However, a low quality wet IPA can not be used for coating because it can cause rusting of the blades during coating. Therefore, dried IPA can be utilised for a substitution technology.

4.9. The existing blade coating system was designed for Freon and tertiary butyl alcohol. The new blade coating system should have the following mechanism and ancillary equipment i.e. a complete razor blade coating system having a fully automatic spray facility consisting of spray booth equipment, transport conveyor all power fitting and disconnects. This also includes a homogenizer which break the suspension particle size from 30 microns to 01 micron at a high pressure of about 8000 PSI. VML has conducted trial studies in their R&D laboratory for an alternate coating process. The new technology incorporate the change of Freon by IPA. The drying chamber is also attached to vaporize IPA before the sintering process. Presently the retrofits are used on experimental basis in smaller batches. It is now proposed to go in for a new coating system. The cost of new coating system would be around (US$ 150,000). The new coating material used would be Vydax-2000 which has 20% dispersion of Fluorotelometer solids in IPA.

4.10. The replacement of ODS in the blade manufacture require alternative processes with extensive engineering know how to carryout tasks such as reliability testing, materials compatibility testing, quality consistency & process development, technology selection for cleaning and coating system, site preparation, installation of machinery and staff training, etc. This was carefully studied by VML, and the company selected a suitable process as an alternate to the existing ODS technology.

4.11. Since Vydax 2000/IPA has a 20 percent dispersion of fluorotelometer solids (half as much Vydax-1000 which has 7.5 per cent), the amount of Vydax-2000/IPA will be needed approximately half as much under a new substitution. The annual consumption of Vydax 2000/IPA is 1600 kg. & IPA is 16.5 MT as shown in Annexure –II

Estimated Consumption of Non-ODS Solvents (Dried IPA)

Description	Unit	Unit Cost US$	Qty/year	Cost/year US$
Dried IPA	Lit	2.2	16.500	36,300

4.12. Ancillary new fire proof equipment with the main system is also required as under.

a.	Homogeniser	1 No.
b.	Mixing Tank	1 No.
c.	Krytox shaker	1 No.
d.	Fire proof exhaust fan	1 No.
e.	Automatic fire extinguishing system	1 No.

4.13. Due to availability of IPA the ODS free coating solutions is flammable and thus the personal and the coating equipment should be properly protected against fire hazard. This can be achieved through installation of an automatic fine water mist fire protection system which allows to extinguish fires at much lower application rates than a conventional water sprinkler system. This choice is based on such characteristics of the system as low occupant risk, suitability for use on energised electrical equipment, high reliability and effectiveness and relatively low cost of installation and maintenance. This equipment is yet to be installed in VML, Thane plant. The cost of the equipment is around US $ 12,000.

Environmental aspects :

4.14. Vidyut Metallics Ltd., Thane plant is employing heat cleaning and IPA based coating process which is technologically accepted world wide. Since the cleaning process involve only heat treatment, no adverse implication to environment are there during cleaning process. With regard to the condensed waste, all the contaminants can be easily removed and economically disposed off. No additional cost are needed since the factory normally burns all the wastes.

Site preparation and installation of machinery :

4.15. The project includes funding to prepare the sites for the equipment installation. This is for electrical supply and plumbing to ensure safe installation of the equipment. Technical staff of the equipment supplier or their agents in India would help the installation work.

Staff Training :

4.16. Since Vidyut have developed in-house process for heat cleaning and coating. The existing Engineers, operators and maintenance personnel have to be trained in operating the new systems. The replacement of ODSs in the razor blades industry applications with IPA processes and heat cleaning technologies will require extensive engineering know-how to carry out to tasks such as :

- Reliability testing
- Material compatibility testing and process development
- Technology selection
- Equipment selection/modification of existing equipment
- Purchase of aqueous cleaning machine and systems
- Site preparation
- Installation of machinery
- Operator training

4.17. Therefore, the overall programme conceived for implementation here includes awareness of the industry towards phasing out of these chemicals and taking up activities with the help of industry, R&D institutions to develop substitutes for the actual usage, as well as taking up demonstration projects with the help of experts in the field and translating the knowledge and experience gained to the other sectors.

Project Costs :

4.18. The project costs refers to all costs including incremental recurring costs. The cost of utilities and solvents may differ between project to project in the country. Annexure-I indicates the total project cost of US$ 472,250. The total project incremental cost of US $ 427,765 was calculated as the investment capital cost US $ 472,250 minus the net incremental operating savings of US$ 44,485 for 04 years discounted at 10%.

Capital Investment Cost :

4.19. As given in Annexure-I, the total investment cost is US $ 472,250. The major components of this cost include the purchase, installation of heat cleaning system and retrofitting of Blade Coating Systems with necessary ancillary equipment.

Incremental Operating Costs/Savings :

4.20. If the project was not undertaken, the annual operating cost could have been US $ 160,488. Once the project is implemented, the annual operating cost is US $ 146,450, resulting in annual operating saving of US $ 14,038. Given an equipment lifetime of 10 years and discount rate of 10% , the net value of the first 04 years of incremental operating savings is US $ 44,485. The details are provided in Annexure II.

Revenues :

4.21. This project provide to Vidyut Metallics Ltd., Thane with US$ 14,038 as annual incremental saving

Local Ownership ratio.

4.22. Since the total project incremental cost should be multiplied by the fraction of local ownership i.e 100% to determine the proposed grant amount, so the total proposed multilateral fund financing is equal to total project incremental cost i.e. US $ 427,765

Contingencies :

4.23 The calculations are based on budgetary quotations and, therefore, suitable amount has been provided as contingencies to meet the unforeseen expenditure.

Unit Abatement cost (UAC) :

4.24 As in Annexure III, the UAC is US $ 3.44 per ODP weighted kilogram of ODS phased out per year. This number is derived from an annualised incremental cost of capital US $ 472,250 and first year incremental annual operating savings of US $ 14,038 and phasing out of 20.05 MT of CFC-113 (16.04 ODP tons) and 2.0 MT CTC (2.2 ODP tons) ODS per year i.e. 18.24 ODP tons.

Proposed MF Grant :

4.25. The proposed MF grant for this project was US $. 427,765 calculated below :

The total investment cost of US $ 472,250 was deducted with the net present value of the incremental operating savings over the first 04 years of the project, which is US $ 44,485. The sum was then multiplied by the 100% Indian ownership ratio of, Vidyut Metallics Ltd., Thane yield the resultant grant of US $ 427,765.

MF Grant Calculation

Total investment cost US $	: 472,250
Incremental Operating costs over the first four years US $	: 44,485
Project preparation cost US $	: 427,765
Proposed MF grant US $	: 427,765

Financing Plan :

MF funding is a grant and is limited to the capital and incremental savings as calculated above.

Project Implementation :

The project will be carried out at Vidyut Metallics Ltd., Thane in co-operation with Ozone Cell, Ministry of Environment and Forests, Government of India. UNIDO will also provide technical assistance to the project during its implementation.

Required Regulatory Action :

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

Direct Project Impacts :

The project will eliminated annually 24.05 MT of ODS (18.24) MT ODP weighted) at VML, Thane.

Annexure - I

Breakdown of total investment (capital) cost

Sl. No	Description of cost item	Unit	Unit cost US $	Qty.	Total cost US$
1.	**Training**				
	Material compatibility, process Development, preparation of Technological documentation, Reliability testing for new Cleaning & coating processes	ea	10,000		10,000
2.	**Equipment Cost**				
	A. Twin chamber vacuum purged heat cleaning furnaces.	set	255,000	01	2,55,000
	B. New blade edge coating system includes spray guns & high voltage controls.	set	96,000	01	96,000
	C. Spray booth & fire proof Exhaust system	set	6,000	01	6,000
	D. Conveyor for furnace, indexing Carrier for Spray & rotary Table	set	16,500	01	16,500
	E. Loading & unloading system for heat cleaning & edge coating	set	13,800	02	Available
	F. Blade carrier	set	1,875	08	Available
3.	**Ancillary Equipment**				
	A. Homogeniser	Nos.	15,000	01	15,000
	B. Mixing tank & shaker	set	3,750	01	3,750
	C. Dust free air circulation System	set	17,00	01	Available
	D. Ammonia cracker with Dryer & storage tank	set	33,000	02	Available
	E. UPS power supply	No	37,500	01	Available
	F. Nitrogen generator	No.	40,000	01	40,000
	G. Water chilling plant	No.	9,000	02	Available
	H. Air compressor	No.	15,000	01	Available
4.	**Others**				
	A. Installation and Commissioning of all Above equipment	set	10,000	01	10,000
	B. Transportation, shipping & insurance	set	10,000	01	10,000
	C. Contingency				10,000
	Total				472,250

Breakdown of incremental cost/ savings

Description of	Unit	Unit cost US $	Qty. per year	Pre-project Total cost US$	Post Project Total cost US$
A. Solvent cost					
1. Vydax - 1000	Kgs.	30.0	1,970	59,100	–
2. CFC-113	Kgs.	4.0	20050	80,200	
3 Vydax –(2000)/IPA	Kgs	30.5	1,600	–	49,800
4. IPA	Kgs.	2.2	16,500	–	36,300
Sub Total				**139,300**	**86,100**
B. Energy Consumption					
1. Ultrasonic cleaning	kwh.	0.1	43,000	4,300	–
2. Spray Unit	Kwh	0.1	128,800	12,888	
3. Heat Cleaning	Kwh	0.1	326,500		32,650
4. New Spray	Kwh	0.1	85,000	–	8,500
5. Conveyor	Kwh	0.1	107,000	–	10,700
6. Cooling System & IPA coating	Kwh.	0.1	150,000	..	15,000
Sub-Total				**17,188**	**58,3500**
C. Labour costs					
C.1 Labour costs (4 machine in three shifts, 12 operators/shifts)	w/m	100	40	4,000	–
C.2 New Labour cost Furnace, spray & Conveyer system 6 Per shifts	w/m	100	20	-	2,000
Sub-Total				**4,000**	**2,000**
TOTAL PRE-PROJECT COST/YEAR				160,488	146,450
TOTAL POST-PROJECT SAVINGS/YEAR					-(14038)

Calculation of Unit-Abatement cost

A. ODS Phase out

A.1	Annual Consumption of		
	• CFC-113	mt	20.05
	• CTC	mt	2.0
			22.05
A.2	*ODP of*		
	• CFC-113		0.8
	• CTC		1.1
A.3	ODP		
	• CFC-113	mt	16.04
	• CTC	mt	2.20
			18.24

B. Annualised Capital Cost

B.1	Total Investment cost from Annexure I	US$	472,250
B.2	Equipment Life	years	10
B.3	Discount rate	%	10
B.4	Annualised Capital cost B.1* 0.1627	US%	76,835
C.	**Annual Incremental Operating Cost/Savings**	US$	14,038

D. Unit abatement cost

D.1	Annualised Capital Cost per kg. ODS phased out (B.4/A.3 * 1000)	US$/Kg.	4.21
D.2	Annual incremental operating savings per kg. phased out (C/A 3 * 1000)	US$/Kg	0.77
D.3	Unit Abatement Cost (D_1 - D_2)	US$/Kg	3.44