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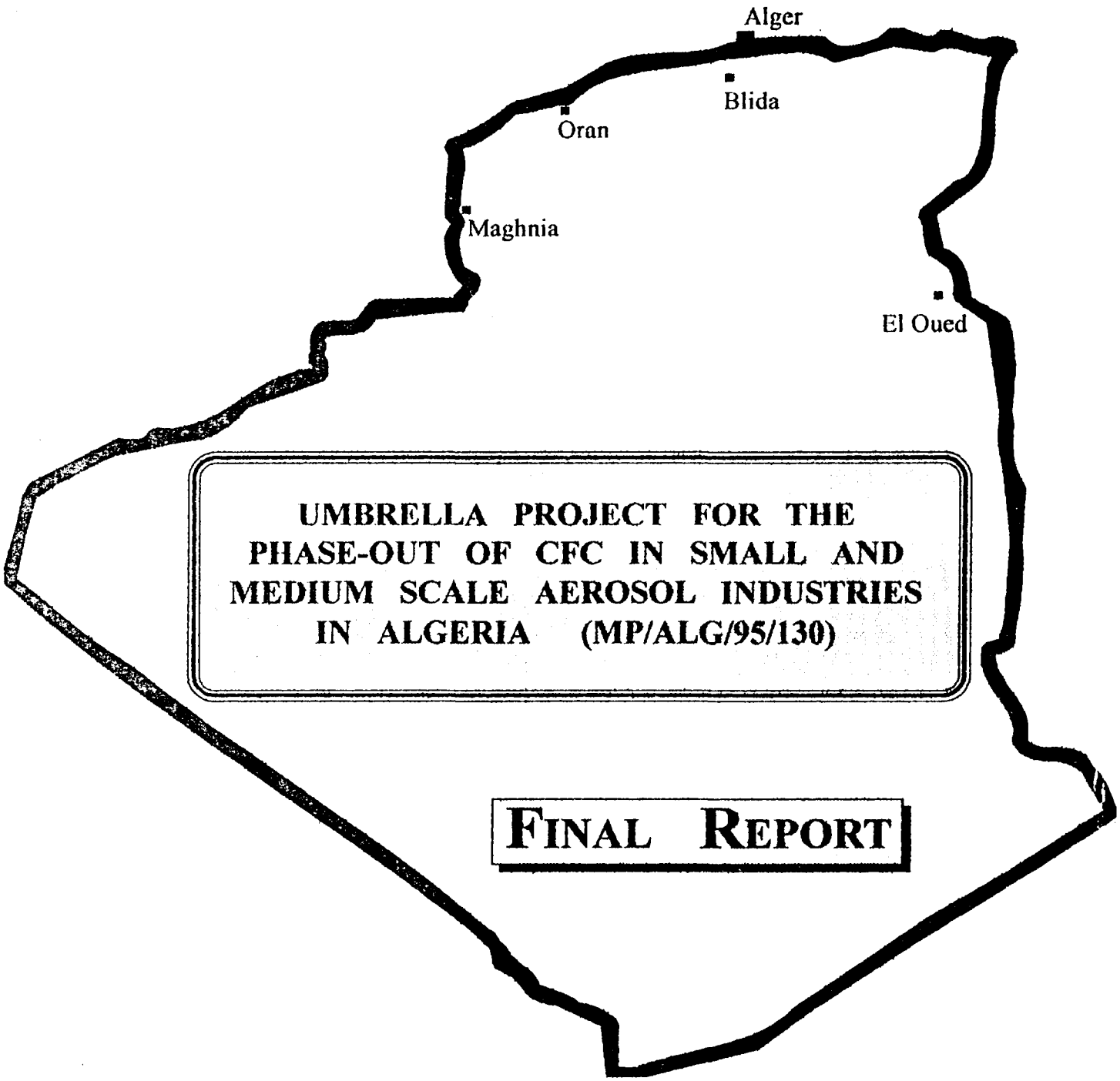

UMBRELLA PROJECT FOR THE PHASE-OUT OF CFC IN SMALL AND MEDIUM SCALE AEROSOL INDUSTRIES IN ALGERIA (MP/ALG/95/130)

FINAL REPORT

June 1996

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SUMMARY

PROJECT COVER SHEET

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Country	:	Algeria
Project Title	:	Umbrella project for the phase-out of CFCs at the seven small and medium size industries.
Sector covered	:	Aerosols.
ODS use in the sector	:	559 mt of CFC 11, CFC 12.
Project impact	:	Phase-out of 196 mt CFC 12 and CFC 11. Total ODP : 196 mt.
Project duration	:	12 months.
Total project cost	:	USD 687,018 *.
Capital cost	:	USD 1,179,210 *.
Incremental operating cost	:	USD - 492,192 *.
Implementing agency's overhead (13 %)	:	USD 89,312 *.
Proposed MF Financing	:	USD 776,330 *.
Cost effectiveness	:	USD / Kg 3.71
Counterpart enterprise	:	Seven companies in Algeria,
Implementing Agency	:	United Nations Industrial Development Organisation (UNIDO).
Coordinating Ministry	:	Direction Générale de l'Environnement Secrétariat d'Etat à l'Environnement.

(* Retroactive financing destined to COPHYD non included).

PROJECT SUMMARY :

This project will phase out 100 % of the use of CFC propellant (CFC 11 and CFC 12) for seven small and medium scale industries in Algeria.

The capacities of consumption of CFCs is approximately 1,000 mt/year, and due to different constraints, these capacities have not been fully utilized. The average consumption, evaluated over the last three years, is of 196 mt/year.

The chosen replacement alternative propellant is hydrocarbon (butane/propane).
LPG is largely available in Algeria and adequate for general use in the industry. However, for specific use in the aerosol industry, the required quality for cosmetics must be imported.

I BACKGROUND :

I.1. Sector background :

The Algerian Country programme, as approved in October 1993, identifies aerosol production as representing 26% of the national consumption of ODS. This percentage represents 559 tons of CFCs consumed in 1991.
In this sector, there are 90 small private companies filling aerosols.
Some companies have already converted to LPG though they do not have sufficient expertise regarding conversion and safety.

A wide action have been initiated by the Bureau National Ozone in order to enforce the data relating to the CFC consumption of the national small and medium scale industries.

I.2. Companies' background :

Amongst the 90 existing companies, the most important seven ones, in terms of CFC consumption, have been identified and selected by the Direction Générale de l'Environnement and the Chambre Nationale du Commerce.

The realisation of the project should allow the elimination of 196 tons (average basis 1993/95) as soon as the financing will be made available.

a) Vague de Fraicheur :

Founded in 1983, Vague de Fraicheur, is a private company, 100 % Algerian ownership.
The aerosol plant is located in the industrial area of Blida, 50 kms south of Algiers.
The 1995 production of aerosols was of 910,000 cans for a total consumption of 51.40 tons of CFC 11 and CFC 12 (The maximum CFC consumption was reached in 1992, with a total quantity of 55 tons). The total staff is of 43 people, 32 of them on the aerosol line of production.

Trade mark	Production : Cans / year	CFC used in Kg	Type of product
La Tchi Tchi and Vague de Fraicheur	590.000	35.400	Antiperspirant 150ml can
SET	320.000	16.000	Antiperspirant 100ml can
TOTAL	910.000	51.400	

The workshop comprises :

- the preparation of the alcoholic mixture (mixing, filtration, and storage of the product).
- the conditioning, as follows :
  - two compact installations PAMASOL P 2040 which are semiautomatic filling and crimping machines for aerosol cans. The following operations can be carried out :
    - ⇒ air blast cleaning of cans,
    - ⇒ product filling,
    - ⇒ crimping,
    - ⇒ propellant filling.

    The units are fully pneumatic with a foot pedal operation. The capacity of each machine is of 8,000 cans per 8 hours shift.

  - four crimping and pressure filling machines PAMASOL P 2005. These units are specially suitable for small scale production with an individual capacity of 5,000 cans per 8 hours shift and are entirely operated pneumatically and released by the means of a foot pedal.

- the packing and delivery,

An experimental action with compressed air as a propellant has been led, however it did not give satisfactory results, especially regarding the quality of the obtained spray.

b) **Parfums WOUROUD** :

This company, entirely owned by an Algerian National who founded it in 1983 to be located in the industrial area of EL OUED, South-East of Algeria, employing a staff of 61, with 12 people in the aerosol workshop.

This workshop is run as follows:

- A COSTER machine, type 52 SM, adapted to perfume bottles "SIXIEME SENS". This machine consists of :
  - a main support fixed to a column, placed centrally to the frame,
  - an intermittent rotating central table with pockets to hold cans,
  - a double conveyor section,
  - a central manifold for all air exhausts to give a quiet operation

  The machine version 52 SM is equipped with the following heads:
  - two product filling heads,
  - one crimping head for 1" valve,
  - two propellant gas filling heads,

  The maximum capacity is of 60 pieces per minute, i.e. 7 million pieces per year.

♦ Three COSTER machines, type 530.
The total capacity is of approximately 8.5 million cans per year. The 1995 production has been of 940,000 bottles and aerosol cans, corresponding to 47 tons of total consumption of CFC 11 and CFC 12, mixed evenly.

Trade mark	Production : Cans / year	CFC used in Kg	Type of product
Opinion	310.000	15.500	Perfume/Antipers. 100ml can
Sixieme Sens	630.000	31.500	Perfume/Antipers. 100ml can
TOTAL	940.000	47.000	

c) Etablissement HAS Mohamed :

The Etablissement HAS Mohamed, founded in 1988, is a private company, entirely owned by an Algerian industrialist.
The plant, located in the industrial area of MAGHNIA, employs 16 people, 12 of them on the aerosol production line.

The output capacity is of 1,000,000 aerosols in one shift, and the production realized in 1995 was 250,000 deodorants in cans of 200 ml. The 1995 consumption of CFC 12 was of 22.5 tons.

Trade mark	Production : Cans / year	CFC used in Kg	Type of product
FRAICHEUR D'OR	250.000	22.500	Deodorant 200 ml can
TOTAL	250.000	22.500	

The workshop includes :
- the preparation of the mixture,
- the conditioning line of :
  * a filling machine, type COSTER 500 DS, semiautomatic, with a foot pedal with a maximum capacity of 2,000 pieces per hour,
  * manual mounting of valves,
  * two semiautomatic machines for fitting the valves and filling with propellant gas, Type COSTER 450G and COSTER 530C, each one with a capacity of 15 to 20 tanks of 18 oz; per minute.
  * the storage of CFC in 2 containers of two tons each,
- the packing and delivery.

d) **Laboratoire BENDI** :

Laboratoire BENDI is a private company, created in 1985 and a 100% owned by a Algerian National.
Located in BIR EL DJIR (ORAN), this company has produced 394,000 aerosol cans, (perfume and hair spray), in 1995.
Their consumption of CFC 11 and CFC 12 was of 19.20 tons in the year 1995.

Trade mark	Production : Cans / year	CFC used in Kg	Type of product
Deodorant H.	95.000	4.750	Antiperspirant 100ml can
Deodorant H.	65.000	6.500	Antiperspirant 200ml can
Laque capillaire	54.000	2.700	Hair Spray 150 ml can
Laque capillaire	30.000	3.000	Hair Spray 300 ml can
Spray Parfum	150.000	2.250	Perfume 30ml can
TOTAL	394.000	19.200	

This company employs 13 people on the aerosol production line among a total staff of 20 people.

The aerosol workshop is organised as follows:
- The preparation of the mixture (materials and ethilic alcohol)
- the conditioning line of :
  * a volumetric dozer, type COSTER 500 DS, running on a semiautomatic cycle, with a foot pedal with a maximum capacity of 2,000 pieces per hour,
  * manual mounting of valves,
  * a combined installation for fitting and filling,, Type PAMASOL P 2005/2 with a capacity of 2,000 fillings per minute. It is pneumatically actioned by command pedal;
  * a compressor of propellant gas, type PAMASOL P 2008 with a theoretical output of 20 litres per minute;
- the packing and delivery.

e) **Etablissement DJEDIDI** :

100% Algerian Ownership, Etablissement DJEDIDI was founded in 1986, though the aerosol production actually started in 1988.

The plant is located in the Algiers suburban area of BAB EZ-ZOUAR and employs 8 people in the production of antiperspirants, hair sprays and perfume atomizers.

The nominal capacity of the two lines is of 6,000,000 cans, however, the 1995 production was slowed down due to special constraints. It went down to 280,000 cans of aerosols for a total consumption of 19.75 tons of CFC 12.

Trade mark	Production : Cans / year	CFC used in Kg	Type of product
YES	80.000	4.000	Antiperspirant 100ml can
YES	150.000	15.000	Hair spray 200ml can
YES	50.000	750	Atomizer 30ml can
TOTAL	280.000	19.750	

The workshop comprises:

- A full line with a filling machine type COSTER 500 DS and a crimping and gas filling machine type COSTER 530/C, of a maximum capacity of 30 pieces per minute.
- An automatic COSTER 6 AVG-M chain, with 3 filling heads for alcoholic mixture, a crimping head and 2 gas filling heads. The valve fitting is manual. Its maximum capacity is of 50/minute.

This plant will need to be relocated once converted to GPL. This action, which cannot be led presently, should be feasable early 1998.

f) SARFA :

SARFA is a private company, founded in 1972 and owned by three Algerian nationals.

The plant is located in Central Algiers and has a total staff of 10 people.

The 1993 production was of 250,000 cans (insecticide and deodorant) with a total consumption of 25 tons of CFC11 and CFC12.

Trade mark	Production : Cans / year	CFC used in Kg	Type of product
Desodorisant Atmosphère	250.000	25.000	Deodorant 200 ml can
TOTAL	250.000	25.000	

During the years 1994 and 1995, SARFA did not consume any CFC, due to procurement difficulties. Their activity should resume during the second half of this year.

The aerosol workshop is organised as follows:

- The preparation of the mixture of active materials, solvents and adjuvants.
- The aspiration of this solution by the means of a volumetric pump and then the filling of cans, once emptied from air
- Fitting of the valves,
- A COSTER machine, type 450G, with a maximum capacity of 8,000 cans/8 hour shift (i.e. 1,760,000/year)
- Storage of CFC 11 and CFC 12 in 1.1 ton containers.
- Packing and delivery.

g) **COPHYD** :

A private entity located in Ain Benian, East of Algiers, COPHYD was founded in 1974 by two associates, Algerian Nationals.
It employs 14 people, 12 of them of the aerosol production chain.

COPHYD's main products are deodorants, antiperspirants and perfumes, made under licence from well known brands such as HARPIC, AIR WICK, MONT ST MICHEL and MATINALE FLIRT.

The maximum consumption of CFC has been of 28 tons in 1989.

Trade mark	Production : Cans / year	CFC used in Kg	Type of product
AIR WICK	102.500	11.275	Deodorant 300 ml can
TOTAL	102.500	11.275	

The average production of the last few years was of 102,500 aerosol cans for an average consumption of 11,3 tons of CFC 12 per year. Since 1993, COPHYD has achieved a total technological reconversion and presently switched exclusively to LPG.

The former line of production comprised the following :
- a dosing machine, type COSTER 500 DS,
- a crimping and gas injecting machine, type COSTER 530 / 20 c, with a maximum output of 40 pieces per minute.
- a gas pump (CFC), type 25 PZG.

The nominal capacity was of 500,000 pieces per an.

The action of reconversion to LPG was decided by COPHYD with the support of the National Chamber of Commerce, which always insisted on the enforcement of the Montreal Protocol to its members.

Nevertheless, COPHYD introduced to the Algerian Authorities in charge of the ozone plan an application for a retroactive financing.

The action of reconversion made necessary the realisation of new facilities comprising:

- the construction work and all the relevant facilities, as well as the purchase of the property, for a total cost to 14,985,208 Algerian Dinars (approximately USD 300,000), entirely supported by COPHYD.
- a complete line for butane conditioning of aerosol cans and LPG storage, supplied by PAMASOL for a total value of 1,340,212 Swiss Francs, i.e. approximately USD 1,072,000. This amount covers the reconversion as well as the development and modernisation of the activity.

1.3. The Umbrella Project :

After the reconversion of ENAD's aerosol plant, which is the most important factory of cosmetic aerosols in Algeria, the decision was made to group small and medium size industries, which CFC respective consumption exceeds 50 tons per year.
These consumption do not justify the formulation of individual projects. These companies have in common :

- ♦ the choice of the alternative technology that is LPG,
- ♦ 100% Algerian ownership,
- ♦ the consumption of CFC11 and CFC12 goes between 11 and 51 tons per year (2 at approx. 50t/year, 4 between 20 and 25 tons and 1 at 11 tons).

These seven companies, altogether, consume 196 mt of CFC per year. Without the enforcement of the Montreal Protocol, they would have consumed up to one thousand tons of CFC yearly.

One of these companies (COPHYD), which had already completed its reconversion, applied for a retroactive financing.

The total investment cost is of USD 911,100 (not including USD 45,000 in retroactive financing to COPHYD).
The yearly savings amount to USD 123,048, i.e. USD 492,192 over four years (not including COPHYD).

These details are shown, by company, on Table I '' Summary of Production, CFC consumption, phase-out investment and savings ''.

II PROJECT OBJECTIVE :

The objective of the project is to phase out completely the use of 196 mt of CFC aerosol propellants (CFC 11 and CFC 12) per year by converting to hydrocarbon seven small and medium scale industries.

III PROJECT DESCRIPTION :

The seven small and medium scale industries of the aerosol sector in Algeria, recognised the need to comply with the Montreal Protocol and have agreed to participate to Algeria's ODS phase-out programme. This project document describes the technology which has been chosen to replace CFCs and the instruments and measures required to convert the existing manufacturing facilities.

3.1. Justification for selection of alternative technologies :

The excellent qualities of the CFC propellants were the main factor in the dynamic growth of aerosols worldwide. In the early years, the quality of the components used such as valves and spray actuators were of very poor quality, and may not have been suitable for use with LPG and high pressure CO2 gases. CFCs offered excellent properties and have been claimed to be the "ideal" aerosol propellent. That is to say until the scientists found that the stratospheric ozone layer is threatened by emissions of CFCs and hallons. Nevertheless, when considering an alternative propellant to CFC, it suitability will always be compared to the positive qualities of CFCs.

♦ **COMPRESSED GASES :**

These include Carbon Dioxide, Nitrous Oxide and Nitrogen . With compressed gases there is no reservoir of liquid propellent, only the amount of propellent that can be dissolved in the concentrate within the pressure limitations of the container can be used. With Carbon Dioxide only a maximum of 4 to 6 % by weight can be dissolved in the product concentrate.

The disadvantages of compressed gas propellants are:
* produce a wet spray,
* fine sprays cannot be obtained,
* need to be dissolved in a good solvent for CO2,

If aerosol cans filled with compressed gas propellent are sprayed upside down even for a very short period, they will use up a large proportion of the propellent and may not empty out all the contents of the can.

Carbon Dioxide is suitable for some products that only require a wet spray such as de-icer, engine cleaner, some insecticides and lubricating oils.

HFC 134 a.

It is non flammable at all concentrations in air at atmospheric pressure, but it does form combustible mixtures with air at pressures greater than 80 volume percent. It is the only non flammable liquefied gas propellent and its non flammable nature is its major advantage.

HFC 134a. may be confined largely to special pharmaceutical and industrial uses in which its non flammable property is needed, and the higher cost of this propellant can be covered by the higher value of consumer items.

HFC 152a.

The cost of HFC 152a is much higher than that of the HAPs, but much less than that of HFC 134a. It has a GWP of 140 over a 100 year Integration Time Horizon.

DIMETHYL ETHER :

DME is a flammable liquefied propellant that is now being used by some major European self fillers and contract fillers. DME has the following advantages :

- It is the least expensive alternative liquefied propellant to HAPs.
- It is an excellent solvent.
- DME is 30 % denser than HAPs.
- It dissolves in water up to about 35 %

It costs between 1.5 and 2 times the price of HAPs. but it is less expensive than HFCs.

DME is the best solvent of any propellent. It is widely used in aerosol paints because it is such a good solvent that inexpensive resins and pigments can be used. It can also be blended with HAPs. One of the major advantages in using DME is that it is soluble in water, this is often a big advantage for the formulation chemist.

The disadvantages of DME are the following :

- cost still too high to be widely used,
- flammable,
- water based formulas can cause corrosion,
- very strong solvent - filling machines need special seals,
- relatively strong ethereal odour.

DME has a wider range of flammable concentrations in air than the hydrocarbons, and must be filled in a similar type of installation. The lower explosion limit (LEL) is higher, which provides marginally greater safety. It is a very reactive chemical and can cause corrosion to both can components and to machine parts such as "o" rings and seals, diameter change parts, and safety guard plastic glazing.

HYDROCARBON AEROSOL PROPELLANTS (HAPs) :

LPG or liquified petroleum gas is the petroleum industry's name for the commercial or fuel grade mixture of n-butane, iso-butane, and propane.

HAPs. is used more than any other propellant as the main replacement for CFCs.

The advantages of hydrocarbon aerosol propellants are :

- Inexpensive
- Similar spray patterns to CFCs.
- Do not affect the ozone layer and very stable
- Reasonable solvent
- Easily manufactured and widely available
- Less dense than water.

Cost is a very important consideration when considering a change in one of the aerosol ingredients, especially a change in propellant. The low of HAPs has always been of interest to aerosol fillers even though they are highly flammable. This flammability subjects has been more of a concern to the fillers than the consumers, as the fillers have had to make investments to make their filling departments suitable for handling and storing LPG gas.

HAPs and CFCs produce virtually identical spray patterns and are probably more stable than CFC propellants.

In the recent rapid change in Europe to convert from CFCs the marketing of HAPs as an "ozone friendly" substitute has been well accepted by the both the media and the consumer.

Another important reason why it has been the main propellant to replace CFCs is because LPG is available worldwide though good quality HAPs are not yet available in every country .It is not always possible to obtain good quality low odour propellants.

The question of poor solvency only affects a few aerosol product categories.

The disadvantages of hydrocarbon aerosol propellants are :

- they are extremely flammable,
- poor solvency sometimes causes problems,
- very low density gives very light products,
- good quality HAPs are not available everywhere.

The LPG specifications in most countries permit wide variations in quality, in some countries the "aerosol grade" of LPG is not really odourless nor much different from straight LPG.

HAPs have a very slight odour as liquids (in the concentrated gaseous phase above the liquid).
They are so pure that they must be transported in completely dedicated tankers to avoid contamination.

The major aerosol products not only in Europe but also in developing countries are :

- hair Sprays and hair mousse,
- deodorants and antiperspirants,
- insecticides,
- room Spray and other household products,
- technical and automotive products,
- paints.

All of these products have been successfully filled using HAPs and it is now obvious that the majority of future conversion projects will be to hydrocarbon aerosol propellants.

No developing country that has HAPs available is using any other propellant as the main replacement for CFCs.

3.2. Choice of technologies :

LPG was the final choice of the seven small and medium scale industries.
This choice was motivated by the unsuccessful experimentation of compressed gas technologies (Azote oxyde and compressed air), as well as the low production costs.

COPHYD had already achieved its reconversion to LPG in 1993, whereas 5 other companies are ready to proceed to their reconversion to LPG as soon as the financing will be available. The last one, (Ets DJEDIDI), though it choose LPG, is not ready for reconversion until 1998.

IV INPUTS :

4.1. Capital goods replacement :

Annex A gives the overall project cost breakdown in terms of equipment type.

The scope of supplies is based on maintaining the present production level and quality of products.

A detailed analysis of savings was performed for each type of aerosol can and calculates for each manufacturer an average value.

For this reason, the seven small and medium scales industries are classified in two categories, taking into account the capacities of the equipments utilized :

* 1st category : Vague de Fraicheur, Wouroud, Djedidi.

* 2nd category : Ets HAS mohamed, Labo. BENDI, SARFA, COPHYD.

All these companies should benefit of an identical project for the storage of LPG, comprising:

A. LPG bulk storage and purification :

A.1. Storage tank of 10 MT capacity, 17 bars at 51°C, with pipework, valves and manometers.

A.2. Off-loading pump, capacity 200 litres per minute to transfer LPG from the truck to the storage tank.

A.3. Pump to put propellant under constant pressure between the tank and the purification columns.

A.4. LPG purification plant, comprising :
- 2 absorber columns, each one with a capacity of 8 litres, stop valves at the end of the cartridges.
- molecular riddle (13 x 80 kg) for approximately 100 m3 of purification capacity.
- Distribution terminal to a gas filling machine.

A.5. A gas detector system and motor control panel for the bulk storage plant. This will include 3 gas sensors and starter controls for off-loading and transfer pumps.

Concerning the three companies of category A, the necessary equipments for LPG filling system are :

B. LPG filling system :

B.1. Gassing machine, capacity 20 to 40 cans per minute, in proportion with the size of the cans.

B.2. Water test bath :
Manual test bath in stainless steel (dimensions : 1.6 m x 0.5 m), with thermic insulation, space for five test baskets, with a capacity of 20 to 40 cans per minute. Ten baskets and electrical controls are provided.

B.3. Hydrocarbon filling room (dimensions: 1.4m wide x 3m long x 2.9m high). The gas house is delivered with the internal propellant pipe work between the gassing machine and the inlet flange fully installed.

B.4. Primary and secondary ventilation systems are provided, each one equipped with a two speed explosion proof fan.

B.5. A hydrocarbon gas manager is required for the filling line and should be located in a safe area of the factory, close to the production line and near the access door in order to go out of the factory to the gas house. This gas manager houses the gas detection controllers and controls the hydrocarbon filling operation. It has fully interlocked system and operates and controls the ventilation and LPG shut-off valves.

B.6. Ten sections of conveyors, of 2.5 m each.

Concerning category B companies (i.e HAS, BENDI, SARFA, COPHYD), the following equipments should be taken into consideration :

B'. LPG filling system :

B'.1. Protection case, built with a metal frame and safety glass, double doors at the front.

B'.2. Double speed axial fan, between 1,000 and 2,000 litres per minute, with an exhaust pipe.

B'.3. Gas detection system comprising a small gas detection device, three gas detectors and a sound signal.

B'.4. Water test bath : Manual test bath in stainless steel (dimensions : 1.6 m x 0.5 m), with thermic insulation, space for five test baskets, with a capacity of 20 to 40 cans per minute.
Ten baskets and electrical controls are provided.

4.2. <u>Conversion / training</u> :

Within the framework of this project, technicians from the seven companies will be trained in the following areas:

- Operation and maintenance of the new machinery and equipment,
- Quality control in relation with conversion,
- Laboratory tests,
- New filling technologies,
- Safety regulations for HAP's.

V PROJECT IMPLEMENTATION :

The project implementation will be carried out by UNIDO in close cooperation with manufacturers. After competitive bidding performed according UNIDO's rules and procedures, a General Contractor will be appointed by UNIDO and the manufacturers for the implementation of the major project components. The General Contractor will be responsible for the supply of equipment, installation, commissioning and training of local staff on the premises. The detailed Terms of Reference for the service to be provided by the General Contractor will be elaborated after project approval.

The final equipment specifications and the work plan could only be elaborated after approval of the basic approach for project implementation by the MFMP.

The permission from the local authorities for the introduction of the new technologies with established national standards is to be obtained by the manufacturers. Having accepted the conversion of their plants to the use of non-ODS under this Project, the manufacturers will be committed to provide the following inputs :

- All activities and costs related to the construction work needed (including the provision of technical infrastructure) to accommodate the new technologies introduced under this project (the relevant construction work will have to be arranged by the manufacturers under the supervision of the General Contractor and in line with the established milestones for this project. The costs for construction work are, therefore, not reflected in the project budget. The specifications for construction work needed will be elaborated by the General Contractor after project approval and the necessary site inspection) ;
- Technical staff as required by the General Contractor
- Provision of tools, transportation and lifting equipment as required;

UNIDO as implementing Agency has the necessary experience and capabilities for the successful implementation of the project at enterprise level. Upon approval of the project by the MFMP, the project's budget will be transferred to UNIDO. The respective project allotment document will then be issued by UNIDO's Finance Section. Any substantive or financial deviation from the approved project is subject to approval by MFMP and UNIDO. The project implementation, milestones are set in Annex E.

VI PROJECT COSTS :

6.1. Incremental operating costs :

The calculation of the overall charges and savings is based on the following average values :

- CFC = 3,00 USD / Kg,
- LPG = 1,20 USD / Kg,
- Ethanol (99 %) = 2,70 USD / Kg,
- Estimated electricity cost (LPG and CFC propellants : 0.005 USD / can).
- Estimated maintenance and insurance costs :
  - ◊ 0,070 USD / can of 75 ml to 300 ml (LPG propellant),
  - ◊ 0.052 USD / can of 30 ml (LPG propellant).
  - ◊ 0.010 USD / can (CFC propellant).

The quantities of CFC per can (perfume, hair spray, antiperspirant) are different due to each company individual formulation.

The result of the savings analysis is summarized in the Table "Summary of savings operating costs". This shows that the total savings costs for the umbrella project for one year of operation is USD 123,048, not including COPHYD.

6.2. Total costs :

The project investment costs, which cover capital investment (at CFC basis) for modification of manufacturing facilities, materials and new machinery are shown in annex A "Equipment specification and Cost breakdown". Cost for transportation and insurance of capital goods are included in the budgeted allocations for the respective items.
Saving operating costs are detailed in Section 6.1.

A contingency of 10% of the investment cost has been added to the project budget cover, unforeseen equipment costs, price increases and other miscellaneous items.

The implementing agency overhead is 13 % of the project value. Annex B shows the overall project budget. The cost effectiveness calculation is given in Annex C.
The total funds requested from the MFMP fund is therefore USD 776,330 for 6 companies to which the retroactive financing should be added (COPHYD : USD 45,000).

TABLE I : SUMMARY OF PRODUCTION, CFC CONSUMPTION AND PHASE OUT INVESTMENT

Company	Output units 1995	CFC11/CFC12 Used mt	Investment Cost USD	Savings 4 years
a. Vague de Fraicheur	910.000	51,40	223.900	77.040
b. Wouroud	940.000	47,00	223.900	101.520
c. Ets. HAS Mohamed	250.000	22,50	134.000	84.000
d. Laboratoire BENDI	394.000	19,20	94.200	54.192
e. Ets DJEDIDI	280.000	19,75	101.100	61.440
f. SARFA	250.000	25,00	134.000	114.000
g. COPHYD (*)	102.500	11,30		
TOTAL	**3.126.500**	**196,15**	**911.100**	**492.192**

(*) Retro-active.

ANNEX A

INVESTMENT WITH EQUIPMENT SPECIFICATION AND COST BREAKDOWN.

	Description	Quantity	Unit cost USD	Total USD
A	**LPG Bulk storage and purification**			
	10 M.T capacity LPG storage tank with pipework and fittings.	4	24.300	97.200
	Off-loading pump	6	10.850	65.100
	Transfer pump	6	9.750	58.500
	LPG purification plant	6	27.500	165.000
	Gas detection system and motor control panel for LPG plant	6	23.800	142.800
	SUB-TOTAL A			**528.600**
B	**Filling system**			
	Gassing machine	2	30.000	60.000
	Hydrocarbon filling room (3.0x2.9x1.4)	2	28.000	56.000
	Case	3	6.800	20.400
	Primary and secondary ventilation	3	19.200	57.600
	Ventilation system	3	5.500	16.500
	Water test bath	4	15.500	62.000
	Gas detection system	6	10.000	60.000
	Conveyor lines 25 m	2	25.000	50.000
	SUB-TOTAL B			**382.500**
	TOTAL A + B *			**911.100**

* Not including COPHYD

ANNEX B
PROJECT BUDGET

Budget line		Cost USD
41-00	Equipment	911.100
	Installation, supervision, commissioning, start-up, training.	177.000
51-00	Miscellaneous	
	Contingency (10%)	91.110
	Incremental operating cost (Savings 4 years)	492.192
99	Sub-total	687.018
	Implementing Agency overhead (13%)	89.312
	Project Total	**776.330**

N.B : Not including COPHYD

Annex B : Project Budget

a) Vague de Fraicheur

Budget line	Description	Budget US$
A.	**LPG Bulk Storage and Purification**	
A1.	10 MT capacity LPG storage tank complete with pipework and fittings	24.300
A2.	Off-loading pump	10.850
A3.	Transfer pump (30 l/minute)	9.750
A4.	LPG purification plant	27.500
A5.	Gas detection system and motor control panel for LPG plant	23.800
	Sub-Total A	96.200
B.	**Filling Machinery**	
B1.	Gassing machine	30.000
B2.	Water test bath	15.500
B3.	Hydrocarbon filling room	28.000
B4.	Primary and secondary ventillation	19.200
B5.	Gas detection system	10.000
B6.	Conveyor lines (25 m)	25.000
	Sub-Total B	127.700
	Sub-Total I	223.900
	Contingency fund (10 %)	22.390
C.	**Installation, Commissioning and Training**	
	- Filling line mechanical installation and commissioning	15.000
	- Filling line electrical installation	15.000
	- Additional training	4.000
	Sub-Total II	280.290
D.	**Savings (4 years)**	77.040
	Sub-Total III	203.250
	Agency Overheads (13 %)	26.423
	Total	229.673

b) WOUROUD

Budget line	Description	Budget US$
A.	**LPG Bulk Storage and Purification**	
A1.	10 MT capacity LPG storage tank complete with pipework and fittings	24.300
A2.	Off-loading pump	10.850
A3.	Transfer pump	9.750
A4.	LPG purification plant	27.500
A5.	Gas detection system and motor control panel for LPG plant	23.800
	Sub-Total A	96.200
B.	**Filling Machinery**	
B1.	Gassing machine	30.000
B2.	Water test bath	15.500
B3.	Hydrocarbon filling room	28.000
B4.	Primary and secondary ventillation	19.200
B5.	Gas detection system	10.000
B5.	Conveyor lines	25.000
	Sub-Total B	127.700
	Sub-Total I	223.900
	Contingency fund (10 %)	22.390
C.	**Installation, Commissioning and Training**	
	- Filling line mechanical installation and commissioning	15.000
	- Filling line electrical installation	15.000
	- Additional training	4.000
	Sub-Total II	280.290
D.	**Savings (4 years)**	101.520
	Sub-Total III	178.770
	Agency Overheads (13 %)	23.240
	Total	202.010

c) Ets HAS Mohamed

Budget line	Description	Budget US$
A.	**LPG Bulk Storage and Purification**	
A1.	10 MT capacity LPG storage tank with pipework and fittings	24.300
A2.	LPG purification columns	27.500
A3.	Gas detection system and motor control panel for LPG plant	23.800
A4.	Off-loading pump	10.850
A5.	Transfer pump	9.750
	Sub-Total A	96.200
B.	**Filling Room**	
B1.	Case	6.800
B2.	Ventillation	5.500
B3.	Gas detection system	10.000
B4.	Water test bath	15.500
	Sub-Total B	37.800
	Sub-Total I (A+B)	134.000
	Contingency fund (10 %)	13.400
C.	Installation, Commissioning and Training	
	- Filling line mechanical installation and commissioning	11.000
	- Filling line electrical installation and commissioning	11.000
	- Additional training	3.000
	Sub-Total II	172.400
D.	Savings (4 years)	84.000
	Sub-Total III	88.400
	Agency Overheads (13 %)	11.492
	Total	99.892

d) LABO BENDI

Budget line	Description	Budget US$
A.	**LPG Bulk Storage and Purification**	
A1.	10 MT capacity LPG storage tank with pipework and fittings *	
A2.	LPG purification columns	27.500
A3.	Gas detection system and motor control panel for LPG plant	23.800
A4.	Off-loading pump	10.850
A5.	Transfer pump	9.750
	Sub-Total A	71.900
B.	**Filling Room**	
B1.	Case	6.800
B2.	Ventillation	5.500
B3.	Gas detection system	10.000
B4.	Water test bath*	
	Sub-Total B	22.300
	Sub-Total I (A+B)	94.200
	Contingency fund (10 %)	9.420
C.	Installation, Commissioning and Training	
	- Filling line mechanical installation and commissioning	10.000
	- Filling line electrical installation and commissioning	10.000
	- Additional training	3.000
	Sub-Total II	126.620
D.	Savings (4 years)	54.192
	Sub-Total III	72.428
	Agency Overheads (13 %)	9.416
	Total	81.844

* [Equipment listed but not counted]

c) Ets DJEDIDI

Budget line	Description	Budget US$
A.	**LPG Bulk Storage and Purification**	
A1.	10 MT capacity LPG storage tank with pipework and fittings*	
A2.	LPG purification columns	27.500
A3.	Gas detection system and motor control panel for LPG plant	23.800
A4.	Off-loading pump	10.850
A5.	Transfer pump	9.750
	Sub-Total A	71.900
B.	**Filling Room**	
B1.	Hydrocarbon filling room *	
B2.	Primary and secondary ventillation	19.200
B3.	Gas detection system	10.000
B4.	Conveyor lines *	
B5.	Water test bath *	
B6.	Gassing machine *	
	Sub-Total B	29.200
	Sub-Total I (A+B)	101.100
	Contingency fund (10 %)	10.110
C.	Installation, Commissioning and Training	
	- Filling line mechanical installation and commissioning	12.000
	- Filling line electrical installation and commissioning	12.000
	- Additional training	3.000
	Sub-Total II	138.210
D.	Savings (4 years)	61.440
	Sub-Total III	76.770
	Agency Overheads (13 %)	9.980
	Total	86.750

* [Equipment listed but not counted]

f) SARFA

Budget line	Description	Budget US$
A.	**LPG Bulk Storage and Purification**	
A1.	10 MT capacity LPG storage tank with pipework and fittings	24.300
A2.	LPG purification columns	27.500
A3.	Gas detection system and motor control panel for LPG plant	23.800
A4.	Off-loading pump	10.850
A5.	Transfer pump	9.750
	Sub-Total A	96.200
B.	**Filling Room**	
B1.	Case	6.800
B2.	Ventillation	5.500
B3.	Gas detection system	10.000
B4.	Water test bath	15.500
	Sub-Total B	37.800
	Sub-Total I (A+B)	134.000
	Contingency fund (10 %)	13.400
C.	Installation, Commissioning and Training	
	- Filling line mechanical installation and commissioning	15.000
	- Filling line electrical installation and commissioning	15.000
	- Additional training	4.000
	Sub-Total II	181.400
D.	Savings (4 years)	114.000
	Sub-Total III	67.400
	Agency Overheads (13 %)	8.762
	Total	76.162

g) COPHYD

Budget line	Description	Budget US$
A.	**LPG Bulk Storage and Purification**	
A1.	10 MT capacity LPG storage tank with pipework and fittings	24.300
A2.	LPG purification columns	27.500
A3.	Gas detection system and motor control panel for LPG plant	23.800
A4.	Off-loading pump	10.850
A5.	Transfer pump	9.750
	Sub-Total A	96.200
B.	**Filling Room**	
B1.	Case	6.800
B2.	Ventillation	5.500
B3.	Gas detection system	10.000
B4.	Water test bath	15.500
	Sub-Total B	37.800
	Sub-Total I (A+B)	134.000
	Contingency fund (10 %)	13.400
C.	Installation, Commissioning and Training	
	- Filling line mechanical installation and commissioning	11.000
	- Filling line electrical installation and commissioning	11.000
	- Additional training	3.000
	Sub-Total II	172.400
D.	Savings (4 years)	24.600
	Sub-Total III	147.800
	Agency Overheads (13 %)	0
	Total *	147.800

* Retroactive financing : USD 45.000

* Difference financed by COPHYD

ANNEX C

CALCULATION OF COST EFFECTIVENESS *

A	ODS Phase-out	Unit	Total Project
A1	Average use of CFC 11 / CFC 12 per year	mt	185
A2	ODP of CFC 11 / CFC 12 (mixed)		1
A3	ODP weighted phase-out	mt	185
B	Capital cost		
B1	Total Investment Cost	USD	911.000
C1	Annual incremental cost (Savings)	USD	492.192
D	Cost Effectiveness		
D1	Investment cost per kg ODS phase-out, B1 / (A3 * 1000)	USD/Kg	4,92
D2	Annual incremental operating cost per kg ODS phase-out, C1(A3 * 1000)	USD/Kg	2,66
D3	Cost Effectiveness D1 - D2	USD/Kg	2,26

Not including COPHYD *.

ANNEX D

Cost of manufacture of 100 ml cans of SET Déo.made by VAGUE DE FRAICHEUR

A. Manufactured, utilizing CFC as propellant,
Quantity : 320,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	80	2.7	0.216
CFC	50	3	0.150
Perfume	2.5	80	0.200
Bactericide	0.1	120	0.012
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.593

Cost of manufacture of 320,000 per year : 0.593 x 320,000 = 189,760 USD

Cost of manufacture of 100 ml cans of SET Déo.made by VAGUE DE FRAICHEUR

B. Manufactured, utilizing LPG as propellant,
Quantity : 320,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	90	2.7	0.243
LPG	30	1.2	0.036
Perfume	2.5	80	0.200
Bactericide	0.1	120	0.012
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.566

Cost of manufacture of 320.000 per year : 0.566 x 320,000 = 181,120 USD

Savings per year : 189,760 - 181,120 = 8,640 USD

Cost of manufacture of 150 ml cans of TCHITCHI and V. de F. for men made by VAGUE DE FRAICHEUR

A. Manufactured, utilizing CFC as propellant,
Quantity : 590,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	110	2.7	0.297
CFC	50	3	0.180
Perfume	3	80	0.200
Bactericide	0.1	120	0.240
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.744

Cost of manufacture of 590,000 per year : 0.744 x 590,000 = 438,960 USD

Cost of manufacture of 150 ml cans of TCHITCHI and V. de F. for men made by VAGUE DE FRAICHEUR

B. Manufactured, utilizing LPG as propellant,
Quantity : 590,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	130	2.7	0.351
LPG	40	1.2	0.048
Perfume	3	80	0.240
Bactericide	0.1	120	0.012
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.726

Cost of manufacture of 590,000 per year : 0.726 x 590,000 = 428,340 USD

Savings per year : 438,960 - 428,340 = 10,620 USD
Total savings for four years : (8,640 + 10,620) x 4 = 77,040 USD

Cost of manufacture of 100 ml cans of SIXIEME SENS and OPINION made by WOUROUD

A. Manufactured, utilizing CFC as propellant,
Quantity : 940,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	62	2.7	0.167
CFC	50	3	0.150
Perfume	6	50	0.300
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.632

Cost of manufacture of 940,000 per year : 0.632 x 940,000 = 594,080 USD

Cost of manufacture of 100 ml cans of SIXIEME SENS and OPINION made by WOUROUD

B. Manufactured, utilizing LPG as propellant,
Quantity : 940,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	72	2.7	0.194
LPG	30	1.2	0.036
Perfume	6	50	0.300
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.605

Cost of manufacture of 940,000 per year : 0.605 x 940,000 = 568,700 USD

Savings per year : 594,080 - 568,700 = 25,380 USD

Total savings for four years : 25,380 x 4 = 101,520 USD

Cost of manufacture of 200 ml cans of FRAICHEUR D'OR made by HAS Mohamed

A. Manufactured, utilizing CFC as propellant,
Quantity : 200,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	60	2.7	0.162
CFC	90	3	0.270
Perfume	10	30	0.300
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.747

Cost of manufacture of 200,000 per year : 0.747 x 200,000 = 186,750 USD

Cost of manufacture of 100 ml cans of FRAICHEUR D'OR made by HAS Mohamed

B. Manufactured, utilizing LPG as propellant,
Quantity : 200,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	80	2.7	0.216
CFC	60	1.2	0.072
Perfume	10	30	0.300
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.633

Cost of manufacture of 200,000 per year : 0.633 x 200,000 = 165,750 USD

Savings per year : 186,750 - 165,750 = 21,000 USD
Total savings for four years : 21,000 x 4 = 84,000 USD

Cost of manufacture of 200 ml cans of DEODORANT made by Labo BENDI

A. Manufactured, utilizing CFC as propellant,
Quantity : 65,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	85	2.7	0.229
CFC	100	3	0.300
Perfume	4	6	0.024
Additives	8	6	0.048
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.616

Cost of manufacture of 65,000 per year : 0.616 x 65,000 = 40,040 USD

Cost of manufacture of 200 ml cans of DEODORANT made by Labo BENDI

B. Manufactured, utilizing LPG as propellant,
Quantity : 65,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	115	2.7	0.310
LPG	60	1.2	0.072
Perfume	4	6	0.024
Additives	8	6	0.048
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.529

Cost of manufacture of 65,000 per year : 0.529 x 65,000 = 34,385 USD

Savings per year : 40,040 - 34,385 = 5,655 USD

Cost of manufacture of 300 ml can of LAQUE CAPILLAIRE made by Labo BENDI

A. Manufactured, utilizing CFC as propellant,
Quantity : 30,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	210	2.7	0.567
CFC	100	3	0.300
Perfume	1	6	0.006
Additives	12	6	0.072
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.960

Cost of manufacture of 30,000 per year : 0.960 x 30,000 = 28,800 USD

Cost of manufacture of 300 ml can of LAQUE CAPILLAIRE made by Labo BENDI

B. Manufactured, utilizing LPG as propellant,
Quantity : 30,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	230	2.7	0.621
LPG	60	1.2	0.072
Perfume	1	6	0.006
Additives	12	6	0.072
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.846

Cost of manufacture of 30,000 per year : 0.846 x 30,000 = 25,380 USD

Savings per year : 28,800 - 25,380 = 5,655 USD

Cost of manufacture of 100 ml can of DEODORANT made by Labo BENDI

A. Manufactured, utilizing CFC as propellant,
Quantity : 95,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	42	2.7	0.113
CFC	50	3	0.150
Perfume	2	6	0.012
Additives	4	6	0.024
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.314

Cost of manufacture of 95,000 per year : 0.314 x 95,000 = 29,830 USD

Cost of manufacture of 100 ml can of DEODORANT made by Labo BENDI

B. Manufactured, utilizing LPG as propellant,
Quantity : 95,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	52	2.7	0.140
LPG	30	1.2	0.036
Perfume	2	6	0.012
Additives	4	6	0.024
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.287

Cost of manufacture of 95,000 per year : 0.287 x 95,000 = 27,265 USD

Savings per year : 29.830 - 27.265 = 5.655 USD

Cost of manufacture of 150 ml can of LAQUE CAPILLAIRE made by Labo BENDI

A. Manufactured, utilizing CFC as propellant,
Quantity : 54,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	105	2.7	0.283
CFC	50	3	0.150
Perfume	0.5	6	0.003
Additives	6	6	0.036
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.487

Cost of manufacture of 54,000 per year : 0.487 x 54,000 = 26,298 USD

Cost of manufacture of 150 ml can of LAQUE CAPILLAIRE made by Labo BENDI

B. Manufactured, utilizing LPG as propellant,
Quantity : 54,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	115	2.7	0.310
LPG	30	1.2	0.036
Perfume	0.5	6	0.003
Additives	6	6	0.036
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.460

Cost of manufacture of 54,000 per year : 0.460 x 54,000 = 24,840 USD

Savings per year : 26,298 - 25,380 = 1,458 USD

Cost of manufacture of 30 ml can of PERFUME made by Labo BENDI

A. Manufactured, utilizing CFC as propellant,
Quantity : 150,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	10	2.7	0.027
CFC	15	3	0.045
Perfume	0.5	6	0.003
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.117

Cost of manufacture of 150,000 per year : 0.117 x 150,000 = 17,550 USD

Cost of manufacture of 30 ml can of PERFUME made by Labo BENDI

B. Manufactured, utilizing LPG as propellant,
Quantity : 150,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	10	2.7	0.027
LPG	10	1.2	0.012
Perfume	0.5	6	0.003
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.040
TOTAL			0.114

Cost of manufacture of 150,000 per year : 0.114 x 150,000 = 17,100 USD

Savings per year : 17,550 - 17,100 = 450 USD

Total savings for four years :
(2,565 + 5,655 + 1,458 + 3,420 + 450) x 4 = 54,192 USD

Cost of manufacture of 100 ml can of YES LAQUE made by Ets DJEDIDI

A. Manufactured, utilizing CFC as propellant,
Quantity : 80,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	45	2.7	0.121
CFC	50	3	0.150
Perfume	5	6	0.300
Bactericide	0.1	120	0.012
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.598

Cost of manufacture of 80,000 per year : 0.598 x 80,000 = 47,840 USD

Cost of manufacture of 100 ml can of YES LAQUE made by Ets DJEDIDI

B. Manufactured, utilizing LPG as propellant,
Quantity : 80,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	55	2.7	0.148
LPG	30	1.2	0.036
Perfume	5	60	0.300
Bactericide	0.1	120	0.012
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.571

Cost of manufacture of 80,000 per year : 0.571 x 80,000 = 45,680 USD

Savings per year : 47,840 - 45,680 = 2,160 USD

Cost of manufacture of 200 ml can of YES LAQUE made by Ets DJEDIDI

A. Manufactured, utilizing CFC as propellant,
Quantity : 150,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	100	2.7	0.270
CFC	100	3	0.300
Perfume	1	30	0.030
Additives	5	30	0.150
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.765

Cost of manufacture of 150,000 per year : 0.765 x 150,000 = 114,750 USD

Cost of manufacture of 200 ml can of YES LAQUE made by Ets DJEDIDI

B. Manufactured, utilizing LPG as propellant,
Quantity : 150,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	130	2.7	0.351
LPG	60	1.2	0.072
Perfume	1	30	0.030
Additives	5	30	0.150
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.678

Cost of manufacture of 150,000 per year : 0.678 x 150,000 = 101,700 USD

Savings per year : 114,750 - 101,700 = 13,050 USD

Cost of manufacture of 30 ml can of YES Atomizer made by Ets DJEDIDI

A. Manufactured, utilizing CFC as propellant,
Quantity : 50,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	5	2.7	0.135
CFC	15	3	0.045
Perfume	1	80	0.300
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.275

Cost of manufacture of 50,000 per year : 0.275 x 50,000 = 13,750 USD

Cost of manufacture of 30 ml can of YES Atomizer made by Ets DJEDIDI

B. Manufactured, utilizing LPG as propellant,
Quantity : 50,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	5	2.7	0.135
LPG	10	1.2	0.012
Perfume	1	80	0.080
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.272

Cost of manufacture of 50,000 per year : 0.272 x 50,000 = 13,600 USD

Savings per year : 13,750 - 13,600 = 150 USD

Total savings for four years :
(2,160 + 13,050 + 150) x 4 = 61,440 USD

Cost of manufacture of 200 ml can of DESODORISANT made by SARFA

A. Manufactured, utilizing CFC as propellant,
Quantity : 250,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	30	2.7	0.081
CFC	100	3	0.300
Perfume	5	60	0.030
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.426

Cost of manufacture of 250,000 per year : 0.426 x 250,000 = 106,500 USD

Cost of manufacture of 200 ml can of DESODORISANT made by SARFA

B. Manufactured, utilizing LPG as propellant,
Quantity : 250,000 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
Alcohol 99,9%	50	2.7	0.135
LPG	60	1.2	0.072
Perfume	5	60	0.030
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.312

Cost of manufacture of 250,000 per year : 0.312 x 250,000 = 78,000 USD

Savings per year : 106,500 - 70,000 = 28,500 USD

Total savings for four years : 28,500 x 4 = 114,000 USD

Cost of manufacture of 300 ml can of AIRWICK made by COPHYD

A. Manufactured, utilizing CFC as propellant,
Quantity : 102,500 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
CFC	110	3	0.330
Perfume	2	100	0.200
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.010
TOTAL			0.545

Cost of manufacture of 102,500 per year : 0.545 x 102,500 = 55,682 USD

Cost of manufacture of 300 ml can of AIRWICK made by COPHYD

B. Manufactured, utilizing LPG as propellant,
Quantity : 102,500 cans per year

Product	Quantity in grams	Price / kg in USD	Cost in USD
LPG	175	1.2	0.210
Perfume	2	100	0.200
Estimated Electricity Cost			0.005
Estimated Maintenance and Safety Cost			0.070
TOTAL			0.485

Cost of manufacture of 102,500 per year : 0.485 x 102,500 = 49,712 USD

Savings per year : 55,682 - 49,712 = 6,150 USD

Total savings for four years : 6,150 x 4 = 24,600 USD

ANNEX E
IMPLEMENTATION SCHEDULE

MILESTONES / MONTHS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Sign the project, receinve funds	→													
2. Appointment of General Contractors, Sites inspections		→	→											
3. Elaboration of detailed project work-plans			→											
4. Draft of plants layouts			→											
5. Training						→				→	→			
6. Selection of equipment - Bidding			→	→	→									
7. Purchase, installation, commissionning					→	→	→	→	→	→	→	→		
8. Testing												→		
9. Start production with LPG													→	→