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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Thirty-second Meeting
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PROJECT PROPOSALS: MOROCCO

This document consist of the comments and recommendations of the Fund Secretariat on the following project proposals:

Foam:

- Phasing out of CFC-11 in the manufacture of rigid polyurethane foam at Engequife by conversion to a combination of water + HCFC-141b based systems UNDP
- Phasing out of CFC-11 in the manufacture of rigid polyurethane foam at Interfer by conversion to a combination of water + HCFC-141b based systems UNDP

Fumigant:

- Phase out of methyl bromide for soil fumigation in strawberry production UNIDO

PROJECT EVALUATION SHEET MOROCCO

SECTOR: Foam ODS use in sector (1999): 581 ODP tonnes

Sub-sector cost-effectiveness thresholds: Rigid US \$7.83/kg

Project Titles:

- (a) Phasing out of CFC-11 in the manufacture of rigid polyurethane foam at Engequife by conversion to a combination of water + HCFC-141b based systems
- (b) Phasing out of CFC-11 in the manufacture of rigid polyurethane foam at Interfer by conversion to a combination of water + HCFC-141b based systems

| Project Data | Rigid | |
|-------------------------------------|--|---------------|
| | Engequife | Interfer |
| Enterprise consumption (ODP tonnes) | 7.80 | 11.00 |
| Project impact (ODP tonnes) | 7.20 | 10.10 |
| Project duration (months) | 36 | 36 |
| Initial amount requested (US \$) | 56,391 | 78,973 |
| Final project cost (US \$): | | |
| Incremental capital cost (a) | 82,000 | 107,500 |
| Contingency cost (b) | 8,200 | 10,750 |
| Incremental operating cost (c) | 11,677 | 20,114 |
| Total project cost (a+b+c) | 101,877 | 138,364 |
| Local ownership (%) | 100% | 100% |
| Export component (%) | 0% | 0% |
| Amount requested (US \$) | 56,391 | 78,973 |
| Cost effectiveness (US \$/kg.) | 7.83 | 7.83 |
| Counterpart funding confirmed? | Yes | Yes |
| National coordinating agency | Ministry of Trade, Industry and Crafts | |
| Implementing agency | UNDP | UNDP |

| Secretariat's Recommendations | | |
|--|--------|--------|
| Amount recommended (US \$) | 56,391 | 78,973 |
| Project impact (ODP tonnes) | 7.20 | 10.10 |
| Cost effectiveness (US \$/kg) | 7.83 | 7.83 |
| Implementing agency support cost (US \$) | 7,331 | 10,266 |
| Total cost to Multilateral Fund (US \$) | 63,722 | 89,239 |

PROJECT DESCRIPTION

Sector Background¹

| | |
|--|-------------------|
| - Latest available total ODS consumption (1999) | 855.55 ODP tonnes |
| - Baseline consumption of Annex A Group I substances (CFCs) | 802.30 ODP tonnes |
| - Consumption of Annex A Group I substances for the year 1999 | 870.60 ODP tonnes |
| - Baseline consumption of CFCs in foam sector | 553.00 ODP tonnes |
| - Consumption of CFCs in foam sector in 1999 | 554.00 ODP tonnes |
| - Funds approved for investment projects in foam sector as of end of 1999 | US\$3,080,667 |
| - Quantity of CFC to be phased out in investment projects in foam sector as of end of 1999 | 636.70 ODP tonnes |
| - Quantity of CFC phased out in investment projects in foam sector as of end of 1999 | 0 ODP tonnes |
| - Funds approved for investment projects in the foam sector in 2000 | US\$0 |
| - Quantity of CFC to be phased out in investment projects in foam sector approved in 2000 | N/A ODP tonnes |

¹ ODS consumption data based on data reported to the Fund Secretariat on 12 October 2000.

As of the time of preparation of this evaluation Morocco had not reported its 1999 ODS consumption data to the Ozone Secretariat.

1. Based on data reported by Morocco to the Ozone Secretariat in 1998, the country needed 121.3 ODP tonnes of CFC to be phased out in order to meet the freeze. As of August 2000, the phase out of 669.9 ODP tonnes of CFC has been approved but not yet implemented. Therefore, the country will be able to meet the 50% reduction of CFC by 2005, and remains in good position for the complete phase out by 2010.

Rigid Foam

- (a) Phasing out of CFC-11 in the manufacture of rigid polyurethane foam at Engequife by conversion to a combination of water + HCFC-141b based systems**
- (b) Phasing out of CFC-11 in the manufacture of rigid polyurethane foam at Interfer by conversion to a combination of water + HCFC-141b based systems**

2. The two companies listed below (Engequife and Interfer) manufacture rigid polyurethane foam sandwich panels for refrigerated truck bodies and cold rooms. Engequife is also involved in sheet steel processing. Both companies use low pressure machines and premixed systems. Their production will be converted to the use of a combination of water and HCFC-141b. This involves replacement of the existing low pressure machines with high pressure machines at the cost of US \$67,000 and US \$90,000 for Engequife and Interfer respectively, and trials, technology transfer and training at US \$15,000 and US \$17,500 respectively. The projects are expected to incur incremental operating cost as indicated in the table below.

Table 1: Profile of the rigid foam-producing enterprises

| Name of Enterprise | Date Established | ODS Consumption OPD tonnes | ODS Phase out ODP tonnes | Baseline Equipment ¹ | Year* | ICC** US \$ | IOC*** US \$ |
|--------------------|------------------|----------------------------|--------------------------|---------------------------------|-------|-------------|--------------|
| Engequife | 1994 | 7.8 | 7.2 | OMS LPD 60 kg/min | 1994 | 90,200 | 11,677 |
| Interfer | 1990 | 11.0 | 10.1 | Cannon C-30 RF3 240 kg/min | 1992 | 118,250 | 20,114 |

*Year – year of purchase and/or installation of equipment

**ICC – incremental capital cost including 10% contingency

***IOC – incremental operating cost

¹ LPD – Low pressure dispenser

Justification for the use of HCFC-141b

3. Justification for the use of HCFC-141b by the two companies has been provided in each project document and as annexes to the document, including projected “techno-economic” impact of zero ODP technologies as well as estimated cost of conversion to zero ODP technology. The Government of Morocco has also provided a letter supporting the use of HCFC-141b by the companies consistent with Decision 27/13.

4. A sample of the justification (additional justification) annexed to the projects and the letter of the Government of Morocco supporting the choice of HCFC-141b are attached to this evaluation.

Impact of the projects

5. A total of 17.3 ODP tonnes will be phased out from the two foam projects. This will eliminate 2% of Morocco’s 1999 consumption of Annex A Group I substances. There will be residual ODS consumption of 1.5 tonnes as a result of the use of HCFC-141b conversion technology.

SECRETARIAT’S COMMENTS AND RECOMMENDATIONS

COMMENTS

1. The Fund Secretariat and UNDP discussed the projects and agreed on the eligible grants.

RECOMMENDATIONS

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

| | Project Title | Project Funding (US\$) | Support Cost (US\$) | Implementing Agency |
|-----|--|-------------------------------|----------------------------|----------------------------|
| (a) | Phasing out of CFC-11 in the manufacture of rigid polyurethane foam at Engequife by conversion to a combination of water + HCFC-141b based systems | 56,391 | 7,331 | UNDP |
| (b) | Phasing out of CFC-11 in the manufacture of rigid polyurethane foam at Interfer by conversion to a combination of water + HCFC-141b based systems | 78,973 | 10,266 | UNDP |

Annex

Additional Justification for Using HCFC-141b Technology

UNDP technical expert appraised the enterprise in June 2000, prior to the preparation of this project document, and had discussions with the company's representatives about the choice of technology for replacing the existing CFC-based technology. The enterprise was briefed in detail about the following:

- (a) An overview of the available interim (low ODP) and permanent (zero ODP) replacement technologies.
- (b) The "techno-economic impact" of each technology on the products manufactured, and the processes and practices employed.
- (c) Possible implications of each technology, in terms of its known impact on environment, health and safety, such as ozone depleting potential, global warming potential, occupational health, etc.
- (d) It was emphasized to the enterprise that HCFC technologies are interim technologies due to their residual ODP and therefore may continue to adversely affect the environment, although at a lower rate than CFCs.
- (e) It was further explained that HCFCs may become controlled substances under present or future international conventions and will therefore also need to be phased out at a future date, and any investments required for their phase-out and for conversion to a permanent technology will have to be borne by the enterprise themselves.

The main conclusions reached by the enterprise through discussions with technical expert were:

1. HCFC-141b will maintain the insulation properties required by the enterprise's customers.
2. All Water based formulations do not provide sufficient insulation properties for the application and would require a significant cost increase to the enterprise.
3. Hydrocarbon technology was seen as not a feasible option due to the layout of the plant operations. The use of hydrocarbons in this environment would be risky and very expensive.

In view of the above, the technology selected is HCFC-141b based systems in the interim, until permanent technology (either water based or HFC-based systems) is available and can provide the required physical properties.

Projected Techno-economic Impact of Zero-ODP Technologies

The projected impact of applying various zero-ODP technologies with respect to the selected technology (HCFC-141b) in this project is summarized as below:

Water based technologies are not sufficiently developed to meet the needs of this application (insulated truck bodies) which has stringent insulation/thickness requirements. Therefore, they cannot be considered.

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

Hydrocarbons cannot be used for safety reasons related to the plant layout.

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

Estimated Cost of Future Conversion to Zero-ODP Technology

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

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

- Water based systems
- HFC based systems

If and when liquid HFC or water-based systems become technically mature and commercially available, the capital investments required to apply this technology are expected to be negligible. The equipment installed/retrofit under this project will be suitable for processing either of these systems. Future costs are expected to be in the area of incremental operating costs, related to higher isocyanate usage (in the case of water based) or higher costs of the HFCs. It is assumed that by the time water-based systems become available, no further density increase will be required.

| | | |
|-------------------------------|--------------------|---------------------|
| Before: | 5,7 t HCFC-141b | @ US\$ 3,20= 18 156 |
| After: | 9,4 t MDI increase | @ US\$ 2,50= 23 646 |
| Incremental Operating Costs/y | | 5 489 |

It is unknown what the price would be of the HFCs in the future; therefore, IOCs related to a potential conversion to HFC technology are not quantifiable at this point.

ROYAUME DU MAROC
MEI
 MINISTÈRE DE L'INDUSTRIE,
 DU COMMERCE, DE L'ÉNERGIE ET DES MINES
 DÉPARTEMENT DU COMMERCE ET DE L'INDUSTRIE
 N° _____ DPI/DICPIC

Rabat, le

ENTERED

OCT 10 2000

FAX

| | |
|--|------------------------|
| Fax n°: 231/00/MEs/DPI/C | Nb de pages: 3 |
| De : DIRECTION DE LA PRODUCTION INDUSTRIELLE Tél: (07) 76 22 97 | Fax: (07) 76 35 37 |
| A : PROGRAMME DES NATIONS UNIES POUR LE DÉVELOPPEMENT | FAX: 00 1 212 906 6947 |
| Att : MONSIEUR F. PINTO | |
| Objet : Reconversion des substances appauvrissant la couche d'ozone dans le secteur de la mousse polyuréthane. | |
| P.J. : 2 | |

Monsieur,

Dans le cadre de la mise en œuvre des dispositions du Protocole de Montréal, le bureau ozone du Maroc a identifié et formulé, avec l'assistance du PNUD, deux projets de reconversion dans le secteur de la mousse polyuréthane.

Ces projets concernent la reconversion des sociétés suivantes:
 INTERFERT ET FNGEQUIFE.

À ce sujet, j'ai l'honneur de vous informer que lesdites Sociétés ont été tenues au courant que les HCFC font partie des substances de transition qui faciliteront le passage à une solution définitive et satisfaisante pour l'environnement.

Aussi, les sociétés concernées se sont engagées à financer par leurs propres moyens la reconversion de la technologie utilisant les HCFC.

Veillez agréer, Monsieur, l'expression de mes salutations distinguées.

Le Directeur de la Production
 Industrielle P.I.

Signé : **Abderrahim CHAKOUR**

PROJECT EVALUATION SHEET MOROCCO

SECTOR: Fumigant ODS use in sector (1999): 767.4 ODP tonnes
(155 ODP in strawberries)

Sub-sector cost-effectiveness thresholds: n/a US \$/kg
n/a US \$/kg

Project Titles:

(a) Phase out of methyl bromide for soil fumigation in strawberry production

| Project Data | Methyl bromide |
|-------------------------------------|------------------------------------|
| Enterprise consumption (ODP tonnes) | 1,279.00 |
| Project impact (ODP tonnes) | 259.00 |
| Project duration (months) | 60 |
| Initial amount requested (US \$) | 3,245,937 |
| Final project cost (US \$): | |
| Incremental capital cost (a) | 2,164,665 |
| Contingency cost (b) | 216,467 |
| Incremental operating cost (c) | 864,805 |
| Total project cost (a+b+c) | 3,245,937 |
| Local ownership (%) | 100% |
| Export component (%) | 0% |
| Amount requested (US \$) | 2,189,729 |
| Cost effectiveness (US \$/kg.) | |
| Counterpart funding confirmed? | |
| National coordinating agency | Ozone Office, Ministry of Industry |
| Implementing agency | UNIDO |

| Secretariat's Recommendations | |
|--|--|
| Amount recommended (US \$) | |
| Project impact (ODP tonnes) | |
| Cost effectiveness (US \$/kg) | |
| Implementing agency support cost (US \$) | |
| Total cost to Multilateral Fund (US \$) | |

PROJECT DESCRIPTION

Phase out of methyl bromide for soil fumigation in strawberry production

Background

2. The Government of Morocco is submitting a project to phase out the entire consumption (155 ODP tonnes) of methyl bromide (MB) used for soil disinfestation in strawberries. During the last ten years, strawberry production increased from 4,582 tonnes covering 205 ha to a total of 70,830 tonnes covering 2,430 ha.

3. Strawberry seedlings are imported from Spain and planted in the fields in September. The planting density ranges between 50,000 and 60.000 plants/ha. The strawberry fields are located along the Atlantic coast in the northern part of Morocco.

4. The strawberry production cycle varies from one to two years. For new planting, clearing of residues from the previous crop is done in July and August; soil preparation for disinfestation is done in August and September. The production period starts with the second yield from the two-year cycle plantings in December and continues until June. The reason for a two-year cycle is to enable harvesting in December (very early production) for export of fresh strawberries to European markets (until March); from April to June strawberries are exported as frozen fruits.

4. The strawberry producers are organized in the “Association Marocaine des Producteurs de Fraise” and into Producers Groups for the management and export of their production through certified packing stations.

MB consumption

5. In 1999, the estimated consumption of MB in Morocco totalled 770 ODP tonnes. Its primary use is for production of tomatoes (390 ODP tonnes), followed by curcubits (161 ODP tonnes) and strawberries (155 ODP tonnes). The remaining 64 ODP tonnes are consumed in the production of bananas and cut flowers.

6. MB consumption for strawberries increased from 22 ODP tonnes in 1992 to 73 ODP tonnes in 1998 and to 155 ODP tonnes in 1999 (a two-fold increase from the previous year).

7. MB is applied using the hot gas method. Once the soil is prepared, polyethylene perforated tubes (application pipes) are lined in the soil surface, and covered with the black mulch plastic sheets. MB is then vaporized in a heat exchange device and delivered as a gas to the soil at a dosage rate of 280 kg/ha. After two or three days, planting holes are made to the plastic sheets.

MB projects already approved

8. The Executive Committee has approved the following MB projects for Morocco:
 - (a) Project to demonstrate four alternatives to the use of MB in horticulture: steam pasteurisation, non-soil cultivation, solarization, and low-dose chemicals, in combination with an IPM, approved by the Committee at its 22nd Meeting at a funding level of US \$487,300 under UNIDO's implementation;
 - (b) Project to demonstrate three alternatives to the use of MB: enemy plants, organic amendments and grafting on resistant rootstocks in combination with an integrated pest management system in tomatoes and cucurbits, approved by the Committee at its 26th Meeting at a funding level of US \$229,523 as a bilateral co-operation project by the Government of Germany;
 - (c) Investment project for the phase-out of 61 OPD tonnes of MB in the production of cut flowers and bananas, approved by the Committee at its 29th Meeting at a funding level of US \$1,006,652 as a bilateral co-operation project by the Government of France.

Export

9. Over the last three production cycles, strawberries have been exported to the European markets as fresh fruit as follows: 34.2 per cent of total production in 1997-1998, 42.6 per cent in 1998-1999, and 17.7 per cent in 1999-2000.

Alternative technologies selected

10. Weeds and leaf diseases are the major pests affecting strawberry production. In two-year cycle crops, root knot nematodes and mites (which develop during summer) affect the quality of the fruit and cause significant loss in crop yield.

11. The alternative technologies selected for phasing out MB are: solarization in combination with metam sodium (in 285 ha); solarization in combination with dichloropropene (in 223 ha); biofumigation (in 247 ha); and negative pressure steam (in 169 ha). These technologies will be applied in combination with an integrated pest management (IPM) programme. The alternative techniques were tested in two crop production cycles (1998-1999 and 1999-2000) and selected based on their technical and economic feasibility.

12. The use of chemical alternatives requires modification of the irrigation systems currently available in farms (estimated at US \$262,625 for metam sodium and US \$73,640 for dichloropropene). Negative pressure steam technology requires installation of perforated pipes in the soil (at a depth of at least 60 cm to be protected from plugging) and an electric fan, at a total cost of US \$5,150/ha and the use of 9 steam generators (at a cost of US \$56,600/unit). Each steam generator is used to treat a surface area of 20 ha.

Training programme

13. The project includes training programmes in the use of the alternative technologies, which will be organised in collaboration with the “Association Marocaine des Producteurs de Fraise”. Approximately 370 farmers and 5 extension agents will be trained in the proposed alternative techniques. The extension agents or trainers will first receive a two-week training by national and international experts in the field of IPM. During the five years of the project, extension agents will train 370 farmers.

Policy measures

14. The country has effective means to control the use and import of MB, which are controlled by an authorization permit issued by the Plant Protection Service valid for a one-year period. MB is applied only by well-trained and qualified technicians, using quality equipment under conditions of strict personnel safety.

15. Upon completion of the project in 2005, the Government will issue a regulation banning MB in the entire strawberry production subsector.

Implementation modalities

16. The project will be implemented by UNIDO in cooperation with the Direction de la Protection des Végétaux, des Contrôles Techniques et de la Repression des Fraudes and the Institut Agronomique et Vétérinaire Hassan II, under the national coordination of the Ozone Unit of the Ministry of Industry.

17. UNIDO will inform the Executive Committee about the progress achieved (through annual reports) indicating phase out achievements and costs involved, and will also inform the Committee on cases of unjustified project delays, which could potentially result in cancellation of the project.

18. The estimated time for the implementation of the project is 5 years.

SECRETARIAT’S COMMENTS AND RECOMMENDATIONS**COMMENTS***Export component*

1. The Secretariat pointed out that the export component has not been considered in the calculation of the eligible cost of the project. UNIDO informed the Secretariat that the majority of the growers export strawberries (as a fresh fruit) through local commercial agencies.

Selection of alternatives

2. Findings from the demonstration project show that biofumigation is an effective alternative technology in controlling the main soil-borne pests and diseases, does not require new equipment or modifications to existing equipment and has low operating costs. Based on these results, the Secretariat sought a clarification from UNIDO on the reasons for not replacing MB completely with biofumigation.

3. The project proposes use of negative pressure steam and solarization in combination with dichloropropene as alternative technologies for the control of root-knot nematodes. Taking into consideration the differences in capital costs of the negative pressure steam technology (US \$1.38 million covering a surface area of 169 ha) and dichloropropene technology (US \$73,600 for a total area of 223 ha), the Secretariat proposed to UNIDO to use only the dichloropropene technology.

4. UNIDO explained that the MB phase-out programme has taken into consideration a gradual reduction in the use of chemical fumigants. Four alternative technologies were tested during the two-year demonstration project; as a result, the soilless culture technology was not technically and economically feasible under Moroccan conditions. The phase out programme will commence in 2001 covering a surface of 139 ha, 80 per cent of which will use chemical alternatives; at the end of the project, only 40 per cent of the surface area will be treated with chemical fumigants. The use of metam sodium in combination with solarization is recommended for control of soil borne fungal diseases and weeds, a problem in all production areas in Morocco; solarization in combination with dichloropropene (control of root-knot nematodes with limited fungicide and herbicide control) is proposed for Gharb and Loukkous regions; bio-fumigation (for nematodes and fungi) will be used where there is availability of a suitable organic matter.

5. UNIDO also informed the Secretariat that during the demonstration project the use of steam sterilization gave good results. During the first year the sheet-steam technique was tested with poor results; since steam was not reaching a required depth in sandy soils. During the second year, the negative pressure technique was used with good results. This technique, which does not require waiting time after its application as in the case of MB, will be used in very intensive production systems (crops grown during summer and therefore there is no time for using other fumigation techniques before planting the strawberry crop) and for some surfaces areas with very high incidence of soil borne pest and diseases. The total area to be treated with this technology is 169 ha.

Incremental costs

6. The Secretariat has sought clarification on the use of negative pressure steam sterilization which requires new equipment. Strawberry farmers want to use this technology for ecological, effective and sustainability reasons. Because of logistical problems and equipment cost, steam cannot be applied to the entire surface area during the project timeframe. Chemical alternatives will be used for a transition period to reach a complete phase out of MB at the completion of the

project (5 years). Afterwards, farmers will gradually replace the chemicals with steam through their own resources. UNIDO also indicated that the low-capacity boiler included in the demonstration project and two other boilers available in the country for the production of cut-flowers will be used.

7. The Secretariat and UNIDO discussed issues related to labour costs associated with irrigation which has never been claimed in MB investment projects; the request for a safety kit for the application of metam sodium; the use of each irrigation equipment (venturi and metam sodium storage tank) in an area of 50 ha rather than 2 ha; and the addition of plastic sheets and labour in the calculation of the operating costs for MB treatment.

8. Incremental operating costs were estimated on the basis of differences in costs between MB and alternative chemicals, using high dosage rates of these products taking into account that these chemicals will be applied in combination with solarization. It has been demonstrated that the dosage rate of chemicals can be reduced when fumigation is combined with solarization. Increasing the activity of a fumigant by solarization and retaining it for a longer time in the soil can be as effective for soil fumigation as the standard procedures. Subsequently, UNIDO agreed to request only the plastic needed for the application of the metam sodium and dichloropropene technologies.

Training programmes

9. The Secretariat and UNIDO agreed to adjust the cost of training programme from US \$447,650 to US \$300,000 considering that MB is applied by registered fumigation companies in Morocco; it is assumed that the staff of the strawberry association consists of high-level scientists and technicians who provide technical support to farmers; the number of farmers to be trained is low (370).

Policy measures

10. Upon a suggestion by the Secretariat UNIDO will prepare an agreement between the Executive Committee and the Government of Morocco with the commitment proposed and an action plan for the phase out of MB in the strawberry sector in Morocco.

RECOMMENDATIONS

1. The Fund Secretariat and UNIDO have agreed on the total cost of the project (US \$2,189,729). The export component has not been taken into consideration. Based on the above considerations, the Executive Committee may wish to consider the level of funding of the project.

2. If the project is approved, the Executive Committee may also wish to request UNIDO to disburse the funds allocated in tranches according to the proposed MB phase out schedule indicated in the project proposal; if Morocco does not meet the reduction requirements outlined

in the proposal, the Multilateral Fund, through UNIDO, will withhold funding for the subsequent tranche of funding until such time as the required reduction has been met.

3. The Executive Committee may also wish to request UNIDO to submit an annual progress report on the implementation of the project to the Fund Secretariat.