

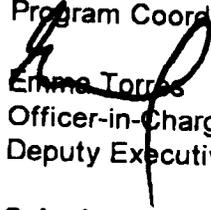


United Nations Development Programme 
GLOBAL ENVIRONMENT FACILITY

To: Mr. Kenneth King
Assistant CEO

Date: 5 November 1999

Attention: Program Coordination

From: 
Emma Torres
Officer-in-Charge and
Deputy Executive Coordinator

Subject: Submission of Medium Size Project Brief for GEF contribution \$750,000 for Cuba: Producing Energy Efficient Home Refrigerators Without making use of Ozone Depleting Substances

Enclosed is a project brief for Cuba entitled: **Producing Energy Efficient Home Refrigerators Without making use of Ozone Depleting Substances** submitted to UNDP by the National Union for the Manufacturing of Durables (INPUD). Please note that the project has been endorsed by the GEF national operational focal point in Cuba.

In accordance with the operational guidance for the preparation and approval of medium-sized projects, we are submitting this to the GEF Secretariat for action by the Chief Executive Office (CEO). We understand that the Secretariat will recommend to the CEO that the project be submitted to the Council for approval, that it be returned for revision or that it not be developed further.

We are simultaneously circulating copies to UNEP/GEF, World Bank/GEF, STAP and the UNFCCC Secretariat for comments to the GEF Secretariat. We expect to receive these comments within 15 working days. Therefore, we look forward to receiving the CEO's decision on or before 9 November 1999 but understand that the project will not be formally approved, even if the CEO has endorsed it, until the Council has reviewed it within the following 15-day period, namely by 30 November 1999.

Thank you and best regards.

cc: Ahmed Djoghlaif, UNEP
Lars Vidaeus, World Bank
Madhav Gadgil, STAP
Rohit Khanna, UNEP/GEF
Mark Griffith, UNEP/STAP
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**UNITED NATIONS DEVELOPMENT PROGRAMME
GLOBAL ENVIRONMENT FACILITY**

Medium-Sized Project Brief - Cuba

<p>1. Project name: <i>Producing energy efficient home refrigerators without making use of ozone depleting substances</i></p>	<p>2. GEF Implementing Agency: <i>UNDP</i></p>
<p>3. Country or countries in which the project is being implemented: <i>Cuba</i></p>	<p>4. Country eligibility: <i>Eligible under paragraph 9(b) of the GEF Instrument. Ratified the UNFCCC in January 1994.</i></p>
<p>5. GEF focal area(s): <i>Climate Change</i></p>	<p>6. Short-term project/measures</p>
<p>7. Project linkage to national priorities, action plans, and programmes: <i>In December 1996 the National Environmental Strategy was adopted identifying the main environmental problems of Cuba and the actions required to minimize negative environmental impacts. In Article 119 of the Environmental Act reference is made to the introduction of regulations to reduce the emissions of green house gasses (GHGs) and those depleting the ozone layer. A National Programme for Electric Power Saving is currently being implemented and a Technical Ozone Office that has been established since 1993 is/was involved in several Ozone projects supported through UNDP/MPU.</i></p>	
<p>8. GEF national operational focal point and date of country endorsement: Ministry of Science, Technology and Environment (CITMA) is the operational focal point in Cuba. The project was formally endorsed on 6 August for 1998.</p>	
<p>9. Project rationale and objectives: 1) <i>Reduction of CO2 emissions related to energy needs of home refrigerators</i> 2) <i>Production of energy efficient home refrigerators without making use of ozone depleting substances</i></p>	<p>Indicators: 1) <i>Lower CO2 emissions related to energy requirements for home refrigerators</i> 2) <i>The quantified use of hydrocarbons as foaming agents (cyclopentane) and cooling agents (isobutane)</i></p>
<p>10. Project outcomes: a) <i>3 new energy efficient home refrigerators have been designed, including their refrigeration systems;</i> b) <i>3 prototypes have been build, tested & modified;</i> c) <i>Prototype energy savings certified, meeting international requirements for class B electric power devices;</i> d) <i>A manufacturing line for 30,000 energy efficient home refrigerators has been designed;</i> e) <i>Manufacturing equipment required will have been purchased and installed;</i> f) <i>Manufacturing line will have been set up and tested;</i> g) <i>Capacity of production and service personnel will have been strengthened;</i> h) <i>Patents, licenses and other necessary documentation will have been acquired;</i> i) <i>A fully equipped laboratory, including capacitated staff, will have been set up;</i> j) <i>An amount of 1,520,239 tonnes of carbon emissions will have been reduced as a result of 15 years of production of home refrigerators.</i></p>	<p>Indicators: (a) <i>Design papers of three new energy efficiency refrigerators, including their refrigeration systems;</i> (b) <i>Three prototypes;</i> (c) <i>Measurements of the savings analyzed and presented in a report;</i> (d) <i>Design papers for a manufacturing line for 30,000 energy efficient home refrigerators per year;</i> (e+f) <i>An operational manufacturing line;</i> (g) <i>Smoothness of the production and delivery of services and/or the number of personnel problems related to production and/or the delivery of services in the warranty shops;</i> (h) <i>Patents, licenses and project documentation;</i> (i) <i>An operational assay laboratory for ISO 9000 accreditation; and</i> (j) <i>Periodic CO2 estimates (monitoring).</i></p>
<p>1. Project activities to achieve outcomes: (a) <i>Designing a new home refrigerator line (US\$ 78,000);</i> (b) <i>Construction of the prototypes (\$ 122,000);</i> (c) <i>Verification of savings (US\$ 18,000);</i> (d) <i>Setting up the manufacturing line (US\$ 354,000);</i> (e) <i>Capacity strengthening (US \$ 98,000)</i> (f) <i>ISO 9000 accreditation (US\$ 70,000)</i> (g) <i>Evaluation (US\$ 10,000)</i></p>	<p>Indicators: (a) <i>Design report of a new energy efficient home refrigerator line;</i> (b) <i>Prototypes ready for testing;</i> (c) <i>Measurements and a report on the savings;</i> (d) <i>Equipment, patents, licenses, project documentation, an operational manufacturing line;</i> (e) <i>Training, study tour, consultancies and a smooth manufacturing operation;</i> (f) <i>A fully equipped, staffed and operational assay</i></p>

	<i>laboratory; and (g) An evaluation report.</i>
12. Estimated budget (in US\$):	
PDF:	0
GEF:	750,000
Co-financing:	25,000 (Government in-kind contribution – wages)
Co-financing:	6,928,000 (Government cash contribution)
TOTAL:	7,703,000
13. Information on project proposer:	
Coordinating Public Authority: Ministry of Foreign Investment and Economic Collaboration (MINVEC)	
National GEF Focal Point: Ministry of Science, Technology and Environment (CITMA)	
Government Executing Agent: Ministry of Steel and Mechanics Industry and Electronics (SIME)	
<i>National Union for the Manufacturing of Durables (INPUD) within the Ministry of Steel and Mechanics Industry and Electronics. INPUD is a Government Enterprise with over 3,000 experienced workers in total out of which 85 are specialized (engineers, technicians) in refrigerator manufacturing. INPUD is known for its good refrigeration manufacturing practices in Cuba. INPUD has good linkages with Universities and R&D institutes and carries out research and evaluations in their factories.</i>	
14. Information on proposed executing agency (if different from above):	
<i>N.A. – see 13</i>	
15. Date of initial submission of project concept: July 1998	
16. Project identification number:	
17. Implementing Agency contact person(s):	
<i>Nick Remple UNDP/RBLAC (fax +1 212 906 6688) and Jafet Enriquez UNDP/Cuba (fax: +537 24 1516)</i>	
18. Project linkage to Implementing Agency programme(s):	
National inventory of green house effect gases (GEF/UNDP); CC: TRAIN Project. Creation of institutional and training capacity for the implementation of the Climatic Change Strategy (GEF/UNDP); Country Case Study on the impact of climatic change adapted to Cuban conditions (UNDP); CUB/98/G31 Project "Grounding for the preparation of the Initial National Communication on the Framework Convention on Climatic Change" (GEF/UNDP); CUB/93/G61 and CUB/98/G61 for institutional strengthening of the Technical Ozone Office (OTOZ); CUB/94/G61 National Program for the Recovery and Recycling of Freon 12 (UNDP); CUB/97/G61 Umbrella Project for the Elimination of R-11 and R-12 in the production of commercial refrigeration equipment in EMPCO-MINCIN and SEGERE-SIME enterprises (UNDP) and a project financed by the UNDP (TRAC 1.1.1/2) entitled CUB/98/001 "Support to the National Electric Power Programme", with a subprogramme on electric power efficiency, is underway in the Electric Power Sector.	

1. Background

Cuba became a party to the United Nations Framework Convention on Climatic Change on June 1992, and on January 1994 ratified it as a Non-Party country on Annex 1 of the Convention. It is making great efforts to compile a National Inventory of Green House Effect Gases, as well as to make a Study on Climatic Change Impacts with its adaptation to Cuban conditions and the formulation of a national strategy for the implementation of the Convention.

The Ministry of Basic Industry has implemented a National Program for Electric Power Saving in Cuba (PAEC) that, through the implementation of various policies and measures, has as its purpose to cut down the use of electric power not only in industries but also in households. Home refrigerators account for more than 50 per cent of the monthly electricity bill. Since there is a large number of old refrigerators still in use in the country, refrigerators are one of the durables that the PAEC has paid greater attention to.

Cuba signed and ratified the 1992 Vienna Convention for the protection of the ozone layer and the Montreal Protocol on Substances Depleting the Ozone Layer and actively participates in these activities. Since 1993, Cuba has a Country Program for a gradual reduction in the use of Substances Depleting the Ozone Layer, has created a National Group for the implementation of the Montreal Protocol with the participation of the most important organizations in the country and has already prepared and is implementing the National Strategy for Substances Depleting the Ozone Layer. Refrigeration and air conditioning account for more than 80 per cent of the consumption of Ozone Depleting Substances (ODSs) in the country.

Environmental protection and sustainable development of natural resources have been lines to which the Cuban Government has given priority attention. As a result of the increasing awareness on the crucial importance of the environment in economic development and sustainability, Cuba established in 1994 the Ministry of Science, Technology and Environment (CITMA). On December 1996, the National Environmental Strategy was adopted, identifying the main environmental problems in the country and the actions required to minimize environmental impact. In Article 119 of the Environmental Act reference is made to the introduction of regulations to reduce the emissions of green house effect gases and those depleting the ozone layer.

The Ministry of Science, Technology and Environment (CITMA) is the national guiding entity of scientific, technological and environmental policy. In environment, it carries out its executive functions through the Environmental Agency of the Ozone Technical Office. The Ministry of Steel and Mechanics Industry and Electronics (SIME) is the main manufacturer of durables in Cuba, including refrigerators. INPUD, an enterprise belonging to SIME, is the only manufacturer of home refrigerators in the country. The CITMA and the Ministry of Basic Industry (MINBAS) regulate the power aspects and establish and develop programs for the refrigerator manufacturing industry.

Former assistance received by the country

Completed or on-going projects related with the Environmental-Climatic Change sub-sector implemented in Cuba through international technical assistance are the following:

- National inventory of greenhouse gases (GEF/UNEP);
- CC: TRAIN Project. Creation of institutional and training capacity for the implementation of the Climatic Change Strategy (GEF/UNDP);

- Country Case Study on the impact of climatic change adapted to Cuban conditions (UNEP); and
- CUB/98/G31 Project "Grounding for the preparation of the Initial National Communication on the Framework Convention on Climatic Change" (GEF/UNDP).

Within the context of the Montreal Protocol, two projects have been approved: CUB/93/G61 and CUB/98/G61 for institutional strengthening of the Technical Ozone Office (OTOZ), both projects have been moved forward through the UNDP. In addition, when regarding Refrigeration and Air Conditioning, the following projects have been implemented:

- CUB/94/G61 National Program for the Recovery and Recycling of Freon 12 (UNDP); and
- CUB/97/G61 Umbrella Project for the Elimination of R-11 and R-12 in the production of commercial refrigeration equipment in EMPCO-MINCIN and SEGERE-SIME enterprises (UNDP)

A project financed by the UNDP (TRAC 1.1.1/2) entitled CUB/98/001 "Support to the National Electric Power Programme", with a sub-programme on electric power efficiency, is underway in the Electric Power Sector.

2. Rationale and objectives

The current stock of home refrigerators in Cuba consists of many old, energy inefficient refrigerators that have been produced making use of ozone depleting substances as foaming agents and refrigerants. Annual replacement and/or the first purchase or additional home refrigerators is 30,000 units and produced solely by Cuban's home refrigerator manufacturer INPUD. Although activities in the commercial refrigeration sector have been undertaken to substitute ODSs with non-ODSs, no activities yet have been undertaken in the home refrigeration sector.

Technologies to produce energy efficient home refrigerators already exist for decades and are being used extensively with great success. In addition, the technology exists to produce home refrigerators without making use of ODSs for the cooling refrigerant and the foaming agents. Despite the latter, relatively new development, few manufacturing lines are equipped to produce home refrigerators without making use of non-ODSs. For the case of Cuba the insulation of home refrigerators is being done with glass wool so there is no ODS involved as a foaming agent. For the cooling refrigerant CFC 12 is being used that has a global warming potential (GWP in relation to CO₂ for a period of 100 years) of 7,300 (i.e. one tonne of CFC 12 has the impact of 7,300 tonnes of CO₂). Combining both types of technologies is hardly ever done in one and the same manufacturing line, certainly not in Cuba nor the Caribbean as a whole.

The Cuban Government has a strong environmental policy that is being implemented with international assistance, for example as indicated above. In this context, the Cuban Government has taken the decision to invest in a new home refrigerator manufacturing line, where the use of ODSs in the manufacturing process will be eliminated. Given the fact that including elements to improve energy efficiency and to make use of non-ODSs is being done most cost-effectively when it is incorporated into the design of a new production line, it is still an incremental cost for which the Cuban Government seeks financial assistance from the UNDP/GEF. The implementation of hydrocarbon technology will be a radical change in Cuban refrigeration manufacturing. It is a proven alternative for HFC technology and shows a higher environmental cost-effectiveness.

The proposed initiative will be one of the first projects worldwide where climate change and ozone depletion will be combined. As such, it will have a large demonstration effect for other countries in the region and beyond. In addition this cross-cutting ODS project is very cost-effective in terms of GEF criteria, since the costs of reducing one tonne of carbon emissions is only US\$ 0.49, which is far less than the US\$ 10/tonne carbon reduced threshold that is being used for financially assisting projects under the GEF short-term measures financing window.

By aiming to overcome the mainly technical barriers, the proposed initiative is consistent with GEF short-term project. GEF support is required to strengthen local capacity for the design and production of a prototype and to assist with the design, establishment and exploitation of a manufacturing line for 30,000 energy efficient home refrigerators annually.

2.1 Development objective

To reduce CO₂ emissions through the production of a home refrigerator with high efficiency and low power consumption making use of substances that do not deplete the ozone layer.

2.2 Immediate objective

To contribute to the efforts of the Cuban Government in the design, establishment and exploitation of a home refrigerator manufacturing line with high-energy efficiency and without making use of ODSs, through the removal of (technical) barriers currently hampering such developments.

3. Barriers

Whereas in the majority of UNDP/GEF Climate Change supported projects there are a mixture of financial, institutional, technical, informational, socio-economical and cultural, barriers, in this proposed initiative there are mainly technical barriers, and to a lesser extent, also informational barriers. Both categories relate to the elements encountered in (environmental) technology transfers.

Technical barriers

Although the technology to make use of hydrocarbon technology for the manufacturing of home refrigerators does exist, it has not yet been introduced to the Cuban manufacturing sector. There is a lack of capacity on designing and building prototypes of energy efficient models, including their refrigeration system that can be produced making use of hydrocarbon technologies such as cyclopentane as a foaming agent and isobutane as a cooling agent. Furthermore, the technical capacity to design, establish and exploit a manufacturing line for energy efficient home refrigerators without making use of ODSs is absent, despite of the fact that the overall technical skills of the Cuban workers at INPUD's home refrigerator manufacturing plant are good. The technology required for the new manufacturing line is not available in Cuba and therefore needs to be imported, since Cuba is currently not able to produce these technologies. The lack of equipment, knowledge and experience for the accreditation of the ISO 9000 standard is a final technical barrier in the development of the proposed activities in this initiative.

Informational barriers

There is a lack of information on practical examples of the different phases of the energy efficient home refrigerator manufacturing without making use of ODSs. In addition, the lack of information on suppliers of hydrocarbon technologies, consultants and on possible training centers for Cuban technicians are other informational barriers currently existing.

4. Expected project outcomes

When the project is completed, INPUD will have a manufacturing plant for the annual production of 30,000 energy efficient home refrigerators using hydrocarbon technology as foaming and cooling agents. The proposed initiative will be one of the first crosscutting climate change/ozone layer depletion projects and as such it will have a considerable demonstration effect for the region and beyond. After three years it is expected that the initiative will have produced the following outcomes:

- Three new energy efficient home refrigerators have been designed, including their refrigeration systems using hydrocarbon technologies;
- Three prototypes have been built, tested and modified if necessary;
- Energy savings of the prototypes have been measured, verified and certified, thereby meeting international requirements for class B electric power devices;
- A manufacturing line for 30,000 energy efficient home refrigerators will have been designed;
- Equipment required for the manufacturing process will have been purchased and installed;
- The following productive activities will have been completed at INPUD in the context of setting up the manufacturing line: shaping, thermoshaping, isolation, preinstallation, installation, vacuuming and filling with the natural refrigerant and final control;
- The capacity to work with the new manufacturing equipment, as well as to provide the service in the warranty shops throughout the country will have been sufficiently strengthened. Forty-two Cuban technicians and specialists will have been trained in the various sections of the refrigerator production line;
- Patents, licenses and other necessary documentation of the new manufacturing equipment and processes will have been acquired;
- An assay laboratory, including the required equipment and trained personnel, will have been set up and exploited to work on meeting the ISO 9000 standards;
- An amount of 1,520,239 tonnes of carbon emissions will have been reduced as a direct result of the production and sales of 430,000 home refrigerators during 15 years of production (see annex 1).

5. Activities

It is anticipated that two levels of activities need to be carried out to reach the point that 30,000 home refrigerator units can be produced annually by the new proposed manufacturing line. The first level of activities relates to the design and construction of a prototype energy efficient home refrigerator that will be produced without making use of ODSs. The second level of activities relates to putting in place the infrastructure – both hardware as well as ‘software’ – for the manufacturing of 30,000 units annually. Both levels are connected through activities that deal with measuring, verifying and certifying savings of the prototype. Activities related to designing and implementing a quality control system (ISO 9000) will complete the list of activities.

Designing a new home refrigerator line

The design of three new refrigeration models; i.e. a 250 l model with one door, a 250 l model with two doors and a 300 l model with two doors, including the hydrocarbon-based refrigeration systems for these models. Possible necessary redesign activities (see *verification of savings below*) after it turns out that the prototypes do not meet the International Electric Power Class B requirements are included in this activity as well. These activities will be sub-contracted and will cost US\$ 78,000. These activities are incremental and therefore UNDP/GEF is requested to cover the full amount. However, the Cuban Government will make available in-kind contributions in the form of counterpart staff time and workshop/laboratory facilities. It is estimated that this in-kind contribution will amount to US\$ 7,500.

Construction of the prototypes

Three prototypes will be built making use of cyclopentane as a foaming agent and hydrocarbons (isobutane) as refrigerant agents and they will be prepared for measuring and verifying energy efficiency improvements being operated under normal Cuban home conditions. Possible necessary modifications (see *verification of savings below*) after it turns out that the prototypes do not meet the International Electric Power Class B requirements are included in this activity as well. This activity will be sub-contracted and will cost US\$ 122,000. This activity is incremental and therefore UNDP/GEF is requested to cover the full amount. However, the Cuban Government will make available in-kind contributions in the form of counterpart staff time and workshop/laboratory facilities. It is estimated that this in-kind contribution will amount to US\$ 12,500.

Verification of savings

Measure, verify and certify the savings of the prototypes and make recommendations for changes to the designed and constructed prototypes if they do not meet the International Electric Power Class B requirements. These activities will be sub-contracted and will cost US\$ 18,000. These activities are incremental and therefore UNDP/GEF is requested to cover the full amount. However, the Cuban Government will make available in-kind contributions in the form of counterpart staff time and workshop/laboratory facilities. It is estimated that this in-kind contribution will amount to US\$ 5,000.

Setting up the manufacturing line - hardware

Design and construct a manufacturing line for 30,000 units annually. The phases that the products have to go through are shaping, thermoshaping, insulation, pre-installation, installation, vacuuming, filling with the natural refrigerant (isobutane) and final control. In order for this to take place specialized equipment has to be purchased and installed followed by a pilot production of series 0 after which the manufacturing line will be modified if necessary. Under this activity falls the majority of the hardware related investments, for which the Government of Cuba will make available some 95% of the required investments. This activity will cost US\$ 6,613,000, building and assembly included, but licenses, patents, technical assistance, training, consultancies, study tours, etc. excluded (see *capacity strengthening*). Included in this hardware package is a R600 loading system required for loading natural refrigerants. This loading system is considered incremental. The cost of such a system is US\$ 354,000 for which financial assistance is requested from UNDP/GEF. The Cuban Government will finance the remaining amount of US\$ 6,259,000. In addition, the Government has reserved a miscellaneous amount of US\$ 200,000 to cover any unforeseen costs.

Capacity strengthening

To ensure that the new hardware for manufacturing energy efficient home refrigerators, through a manufacturing process that makes use of cyclopentane as a foaming agent and isobutane as a

refrigerant agent a number of specialized activities under the heading capacity strengthening need to be undertaken; i) study tour to the best facilities that are already making use of the proposed technology interventions (2 people), ii) to identify future training places (this can be combined with the study tour), iii) training for a) cyclopentane foaming (2 people), b) vacuuming and filling with R600 (2 people), c) preinstallation and installation (2 people) and d) final control (2 people) and iv) consultancies in each of the 4 sections for the training of 10 technicians. Also personnel of the warranty shops throughout the country will be trained such that warranty service can be provided. These activities will cost US\$ 138,000 out of which US\$ 98,000 are incremental costs, for which UNDP/GEF financial assistance is requested. In addition to the capacity strengthening activities the patents, licenses and other documentation need to be acquired. This activity will cost US\$ 366,000 and will be fully covered by the Cuban Government.

ISO 9000 accreditation

It is anticipated that meeting ISO 9000 standards for the home refrigerators will increase the lifetime of the products and as such it will be beneficial for the Cuban customers and the local and global environments alike. In addition, meeting ISO 9000 standards opens up the possibility for export of Cuban manufactured home refrigerators. Activities required to be accredited by the ISO 9000 standard are i) the purchasing of the required equipment, instruments and tools, ii) elaboration of accreditation procedures and protocols, iii) adjusting and gauging of equipment and instruments, and iv) consultancies on accreditation processes for the accreditation of the laboratory (1 person) and training on laboratory techniques (2 people). This activity will cost US\$ 133,000 out of which US\$ 70,000 are incremental costs, for which UNDP/GEF financial assistance is requested.

Evaluation

To monitor the impacts of the UNDP/GEF intervention, it is necessary to create a baseline situation and develop indicators and a methodology for monitoring changes, followed by actual monitoring changes to be used as an input to the UNDP/GEF evaluation of the proposed initiative. This activity will cost US\$ 10,000 and is incremental. Thus, UNDP/GEF is requested to cover the whole amount.

6. Sustainability of the initiative

The long-term sustainability of the proposed initiative will be enhanced through:

- The proposed activities are initiated by the Cuban Government who has a very firm commitment to this project as can clearly be seen by the level of co-financing for this initiative;
- The policy context in which the proposed initiative needs to be undertaken is favorable for successful implementation of the activities as well as for long-term sustainability;
- The creation of a manufacturing infrastructure, both in terms of hardware and software (capacity strengthening for the design, establishment and exploitation of the manufacturing line);
- Anticipated long-term benefits for the Cuban households in the form of lower monthly electricity costs for cooling will secure a future market for energy efficient home refrigerators;
- Currently the INPUD "Primero de Mayo" factory in Santa Clara, established in 1963 is the only factory in Cuba producing home refrigeration, thus internal competition is absent. However competition from import exists, but at current prices the Cuban refrigerators are cheaper than the foreign competition;

- The activities related to the accreditation of the ISO 9000 standards create a basis for manufacturing energy efficient home refrigerators that can be exported and as such the incentives exist to develop and continue high quality refrigerators.

7. Risks

The following main risks related to the operationalization and sustainable implementation of the activities as well as the proposed implementation arrangements exist and/or are anticipated:

- Import of low-cost energy efficient refrigerators that do not make use of natural refrigerants nor has use been made of hydrocarbons as foaming agents. Currently the combination of low wages, skilled personnel sufficiently capacitated to work with the new energy efficiency and hydro carbon technologies, new and up-to-date (efficient) manufacturing line and the government control over the manufacturing and import makes it unlikely that less costly imported energy efficient home refrigerators can be offered at the Cuban consumer market;
- Linking R&D activities with manufacturing might be difficult to organize, since different institutions will be involved with their own approaches. INPUD is a highly diversified enterprise, with an experienced staff of 3,000 workers - engineers, technicians, designers and framers. A small staff is linked through collaboration plans with the Central University "Marta Abreu" and the Polytechnic Institute "General Lazaro Cardenas". Both are located in Santa Clara and already carry out research and evaluations in the factory. It would be possible to extend these linkages for the proposed initiative;
- Difficulties in the purchase of foreign equipment might delay the assembly and exploitation of the manufacturing line. The UNDP office in Havana will be requested to actively intervene in the purchase of international equipment as appropriate;
- Difficulties in the identification and contracting of foreign companies for technology transfer training and consultancies might interrupt the technology transfer and smooth and timely implementation of the proposed activities. The UNDP office in Havana will be requested to actively intervene in the identification, selection and contracting of foreign companies as appropriate; and
- High prices of raw materials and components in the available distant markets may result in purchase difficulties that may temporarily affect the expected production levels. A continuous tracking of international suppliers of raw materials and components will be undertaken as part of the activities *setting up the manufacturing line - hardware and capacity strengthening*. In addition the Cuban Government has indicated that they will be exploring avenues how to produce themselves the required hydrocarbons for the proposed manufacturing process.

8. Stakeholder involvement and beneficiaries

The proposed activities have been initiated by the national technical authorities of INPUD who have prepared a proposal, in close collaboration with UNDP Havana. In order for INPUD to prepare the proposal they have consulted with the Ministry of the Metallurgical Industry and Electronics (SIME), the Ministry of Science, Technology and Environment (CITMA) and the National Technical Ozone Office (OTOZ). In addition the Central University "Marta Abreu" and the Polytechnic Institute "General Lazaro Cardenas" have been consulted. Apart from a market survey to assess the quantity of annual replacements and new home refrigerators, end-users (i.e. households) have not been included in the preparation of this initiative nor will they be in the implementation.

Direct beneficiaries of this initiative will be INPUD, the only enterprise producing home refrigerators in Cuba, who will be equipped with a state-of-the-art manufacturing line for home refrigerators. Also the Cuban households that will make use of the new energy efficient home

refrigerators and will directly benefit from the lower power consumption resulting in lower monthly electricity bills.

In addition, the global environment will be an in-direct beneficiary of the reduction of Greenhouse Gasses due to lower energy consumption and the use of hydrocarbons with a very low Global Warming Potential. Furthermore the use of hydrocarbon technologies eliminates the use of ozone depleting substances and as such no negative effects on the ozone layer depletion originate from this initiative. The demonstration effect that this crosscutting ODSs project has for other countries in the region and beyond is another indirect benefit arising from this initiative.

9. Incremental cost matrix and analysis

The goal sought by the proposed initiative is to contribute to the efforts of the Cuban Government in the design, establishment and exploitation of a home refrigerator manufacturing line with high-energy efficiency and without making use of ODSs, through the removal of technical and informational barriers.

In a business as usual scenario there will remain a lack of equipment and capacity to produce energy efficient home refrigerators without making use of ODSs. Due to the lack of national incentives to substitute ODSs with hydrocarbons it is expected that without the proposed initiative home refrigerators will be produced making use of ODSs. Although energy efficient home refrigerators will be produced anyway, the proposed activities will speed up that process and enhance the effectiveness of the production.

Seven activities have been designed to remove technical and informational barriers that hamper the energy efficient production of home refrigerators without making use of ODSs. In summary the proposed initiative undertakes all necessary activities related to technology transfer, both hardware and 'software' to set up a manufacturing line for 30,000 energy efficient home refrigerators annually. All of the incremental costs requested are related to the costs of removing the barriers identified. The incremental costs of each activity are briefly summarised in the following matrix.

Incremental Cost Matrix

Activity	Baseline (B)	Alternative (A)	Increment (A-B)
Designing a new home refrigerator line			
Global Environmental Benefits	No technical designs available	Technical designs developed through consultancies	Technical designs available
Domestic Benefits			
Costs	0	US\$ 78,000	US\$ 78,000
Constructing prototypes			
Global Environmental Benefits	No prototypes available	Prototypes constructed and made ready for testing	Prototypes available
Domestic Benefits			
Costs	0	US\$ 122,000	US\$ 122,000
Verification of savings			
Global Environmental Benefits	Exact power consumption not known	Measured power consumption	Known power consumption
Domestic Benefits			
Costs	0	US\$ 18,000	US\$ 18,000
Setting up a manufacturing line			
Global Environmental Benefits	Use of ODSs during manufacturing	Hydro carbons used during manufacturing	Reduced ODSs
Domestic Benefits	Old inefficient home refrigerator manufacturing line	New, improved home refrigerator manufacturing line	New up-to-date home refrigerator manufacturing line
Costs	US\$ 6,459,000	US\$ 6,813,000	US\$ 354,000
Capacity strengthening			
Global Environmental Benefits	Limited trained personnel	Training and study tours held	Sufficiently trained personnel
Domestic Benefits	No progress in technical developments	Specialised capacity strengthening	Conditions for technical development partially created
Costs	US\$ 406,000	US\$ 504,000	US\$ 98,000
ISO 9000 accreditation			
Global Environmental Benefits	No standardisation	Standardisation	Standardisation conditions put in place
Domestic Benefits	The lack of standardisation of home refrigerators prevents export	Standardisation	Opening of the export market
Costs	US\$ 63,000	US\$ 133,000	US\$ 70,000
Evaluation			
Costs	0	US\$ 10,000	US\$ 10,000
Miscellaneous			
Costs (wages)	US\$ 25,000	US\$ 25,000	0
TOTAL PROJECT			
Global Environmental Benefits	Energy inefficient home refrigerators produced by making use of ODS	Energy efficient home refrigerators produced making use of hydrocarbon technologies	Substitution of ODSs and a reduction in power consumption; Reduction of 1,520,239 tonnes of carbon
Domestic Benefits	High power consumption of home refrigerators	Low power consumption of home refrigerators	Reduction in power consumption and local pollution

Costs	US\$ 6,953,000	US\$ 7,703,000	US\$ 750,000
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The matrix shows that an investment of US\$750,000 in barrier-removing activities will produce, in addition to other domestic benefits, global benefits of 1,520,239 tonnes of carbon, implying a carbon abatement cost of US\$ 0.49 per tonne of carbon.

10. Budget by input

Component	GEF	Host Government	Project total
PDF:	0		0
Subcontracts:	236,000		236,000
• <i>International</i>	130,000		
• <i>National</i>	106,000		
Travel (int. sub-contracts):	22,000		22,000
Training:	75,000	40,000	115,000
Study tours:	23,000		23,000
Equipment:	384,000	6,459,000	6,843,000
• <i>R600 loading system</i>	354,000		
• <i>Manufacturing equipment</i>		6,259,000	
• <i>Office and laboratory</i>	30,000		
• <i>Unforeseen costs</i>		200,000	
Evaluation:	10,000		10,000
Patents, licenses, documentation:		366,000	366,000
Miscellaneous:		88,000	88,000
• <i>Technical assistance</i>		63,000	
• <i>In-kind contribution (wages)</i>		25,000	
Project total	750,000	6,953,000	7,703,000

11. Project implementation plan

The project implementation modality will be National Execution (NEX) through the UNDP Office in Havana. The executing agency will be SIME, whereas INPUD will be the implementing agency. All nationally executed UNDP projects in Cuba are coordinated by/with the Ministry of Foreign Investment and Economic Collaboration. CITMA will play an advisory role.

A programme management unit (PMU) will be set up at INPUD to manage and co-ordinate different inputs in the implementation process. INPUD will also provide the programme manager. The PMU will work closely with the UNDP office in Havana for the implementation of the work plan. As part of the Project Document Phase, the project's detailed implementation plan, work plan and Terms of References will be prepared. The following table presents the first draft of the proposed implementation work plan.

Project implementation work plan

ACTIVITIES	DURATION OF PROJECT 36 MONTHS											
	PROJECT QUARTERS											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Designing a new home refrigerator line	■											
Construction of prototypes		■										
Verification of savings			■									
Setting up the manufacturing line				■								
Capacity strengthening					■		■			■		
ISO 9000 accreditation						■						
Evaluation												■

12. Monitoring and evaluation plan

The implementation of the project will be closely monitored in accordance with UNDP established monitoring procedures by UNDP-Havana in consultation with UNDP/RBLAC and the UNDP/GEF core unit. Possible involvement from the UNDP/MPU will be discussed at the Project Document Phase. The methodologies for monitoring and evaluating the achievement of energy savings by the newly designed, build and disseminated home refrigerators will draw upon the framework established under the International Performance Measurement and Verification Protocol (IPMVP). In addition compliance with the international requirements for class B electric power devices will be monitored.

The project will be annually subject to joint reviews by representatives of the Government and of the UNDP. The first of these meetings will take place within the first 12 months of the full implementation of the project. The programme manager of the project will draft and submit to each review meeting a Project Performance Evaluation Report (PPER). If necessary, additional PPERs may be requested during the implementation of project. A final report on the project will be submitted for the consideration of the final review meeting. A draft should be submitted at least four months before the final review meeting to be considered by the Government and the UNDP. The project will be evaluated when its implementation is half way through and at the end of the project. During the Project Document Phase the Terms of Reference for the evaluations will be prepared.

At the outset of the project implementation a project steering committee will be set up and will be put in charge of providing adequate monitoring and steering of the activities to be developed. The Terms of Reference for such a steering committee will be prepared during the Project Document Phase. At minimum the following organisations need to be represented in the steering committee: INPUD, SIME, CITMA, MINBAS, UNDP and the Ministry of Foreign Investment and Economic Collaboration.

13. Project checklist

PROJECT ACTIVITY CATEGORIES			
Biodiversity	Climate Change	International Waters	Ozone Depletion
Prot. Area zoning/mgmt:	Efficient prod. & distribution:	Water body	Monitoring
Buffer zone devpt:	Efficient consumption: X	Integrated land & water:	Country programme:
Inventory/monitoring:	Solar:	Contaminant:	ODS phaseout: X
Ecotourism:	Biomass:	Other:	Production: X
Agro-biodiversity:	Wind:		Other:
Trust fund(s):	Hydro:		
Benefit-sharing:	Geothermal:		
Other:	Fuel cells:		
	Other:		
TECHNICAL CATEGORIES			
Institution building:			
Investments:			
Policy advice:			
Targeted research:			
Technical/management advice: X			
Technology transfer: X			
Awareness/information/training: X			
Other:			

14. Technical review

(Not obligatory: project under \$750,000)

Annex 1**Carbon emission reduction calculations**

Following are the estimates of the carbon emission reduction as a result of the implementation of the proposed initiative:

A: Carbon emission reduction resulting from energy savings***Basis for the estimates:***

1. The time over which the carbon emission reduction will be calculated is for those units that have been produced during 15 years;
2. Annual number of energy efficient refrigerators produced and sold (new/replacements);

Year	Units/year
1	10,000
2-15	30,000

3. Cumulative number of 'unit-years' that account for a reduction in carbon emissions during the 15-years of production is: $(14 \times 30,000 + 10,000) \times 15 = 6,450,000$;
4. Daily power consumption of the currently used old refrigerators is 3 kWh/24 hours;
5. Daily power consumption of the new energy efficient refrigerators is 0.9 kWh/24 hours (i.e. meeting the international requirements for Class B electric power devices);
6. Fuel consumption per generated kWh is 280 gram;
7. System power losses are 17%;
8. Fuel consumption per kWh consumed is therefore 327 gram;
9. CO₂ not emitted per generated kWh is 0.9 kg; and
10. CO₂ not emitted per consumed kWh is 1.05 kg and this equals $12/44 \times 1.05 = 0.29$ kg of carbon.

Calculations of carbon not emitted:

- Electric power savings per refrigerator per year are $(3-0.9)$ kWh/24 hours \times 365 days = 767 kWh.
- Electric power savings resulting from 15 years of production = $6,450,000 \times 767$ kWh = 4,947 GWh;
- Carbon not emitted as a result of the energy savings is $4.947E9$ kWh \times 0.29 kg = 1,434,630 tonnes.

B: Carbon emission reduction resulting from CFC 12 phase out/substitution***Basis for the estimates:***

1. The time over which the carbon emission reduction will be calculated is for those units that have been produced during 15 years;
2. In these 15 years $10,000 + (14 \times 30,000) = 430,000$ units will have been produced;
3. CFC 12 charge per refrigerator is 100 gram;

4. Thus 43 tonnes of CFC 12 will be phased out/substituted;
5. No foaming agent needs to be substituted because of the current use of glass wool for the insulation material.

Calculations of carbon not emitted:

6. The Global Warming Potential of CFC 12 is 7,300 (i.e one tonne of CFC 12 has the impact of 7,300 tonnes of CO₂);
7. Thus $43 \times 7,300 \times 12/44 = 85,609$ tonnes of carbon that will not be emitted.

TOTAL carbon not emitted and associated costs:

- $1,4343,630 + 85,609 = 1,520,239$ tonnes of carbon not emitted;
- Carbon abatement cost = $1,520,239 / 750,000$ US Dollars = 0.49 US Dollars/tonne of carbon

DIRECCIÓN DE TECNOLOGÍA Y MEDIO AMBIENTE
Dirección de Colaboración Internacional



CITMA DCI: 926/97

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Ciudad de la Habana, 4 de septiembre de 1999

Sr. Luis Gómez-Echeverri
Representante Residente
PNUD
1516

Proyecto de Tamaño Mediano GEF/PNUD " Producing energy efficient
refrigerators without making use of ozone depleting substances"

Estimado Sr. Gómez-Echeverri:

Adjunto envío la versión corregida del documento de Proyecto antes mencionado, que reviste gran importancia para Cuba, ya que la recuperación de la industria nacional de producción de refrigeradores domésticos constituye una tarea de máxima prioridad, debido a la alta demanda existente en el país.

La reconversión de la Empresa INPUD, -única productora de refrigeradores domésticos en Cuba -, mediante la sustitución de la tecnología de CFC por hidrocarburos, se enmarca en la política ambiental cubana para la protección de la Capa de Ozono y la reducción de emisiones de gases de efecto de invernadero.

Solicito su cooperación para que esta propuesta sea presentada al FMAM según procedimientos establecidos para los proyectos de tamaño mediano, con vistas a aprobación final e inicio de ejecución.

Atentamente,

Humberto Arango Sales
Director
Punto Focal Operacional del GEF



cc. Pedro Morales, Director DOEI, MINVEC

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