

**UNITED NATIONS DEVELOPMENT PROGRAMME**  
*Project of the Government of  
 The People's Republic of China*  
**PROJECT DOCUMENT**

Project Budget Number: CPR/98/G31/A/1G/99  
 Project Title: Barrier Removal for the Widespread  
 Commercialization of Energy-efficient  
 CFC-free Refrigerators in China

Estimated Start Date: July 1999  
 Estimated End Date: July 2003  
 Executing Agency: State Environment Protection  
 Administration (SEPA)  
 Cooperating Agency: United Nations Department  
 for Economic and Social Affairs (DESA)

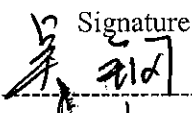
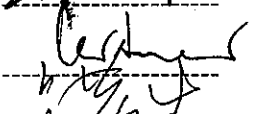
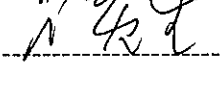
Govt Implementing Agency: Foreign Economic Cooperation Office, SEPA  
 Project Site: Beijing and sites in other provinces

**Classification Information:**

<b>CC sector and sub-sector:</b> Environment	<b>Primary type of intervention:</b> Capacity Building
<b>DCAS sector &amp; sub-sector:</b> Energy Efficiency	<b>Secondary type of intervention:</b> Envi.preservation Direct Training
<b>Primary areas of focus/sub-focus:</b> Promoting Envi. & Natr.Resources Sustainability	<b>Primary target beneficiaries:</b> Govt. Organizations Enterprises
	<b>Secondary target beneficiaries:</b> Professional Groups/associations

**Brief Description**

The project will promote the widespread commercialization of energy-efficient refrigerators by removing technical, market, commercial, information and other barriers to increased market penetration of the technologies and products. The activities developed for the project can be generally grouped into those providing a "technology push" to increase the supply of energy efficient refrigerators, and those providing "demand pull" to raise retailer and consumer understanding of the benefits of energy efficient refrigerators in China. .

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Nat'l Govt.	\$1,370,000
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<b>Total:</b>	<b>\$ 40,906,500</b>

## Table of Contents

<b>A</b>	<b>CONTEXT</b> .....	<b>1</b>
A.1	Description of Sub-sector .....	1
A.2	Host Country Strategy .....	2
A.3	Prior or Ongoing Assistance .....	3
A.4	Institutional Framework for Sub-sector .....	5
<b>B</b>	<b>PROJECT JUSTIFICATION</b> .....	<b>6</b>
B.1	Problems to be addressed: The Present Situation .....	6
B.2	Expected End of Project Situation .....	8
B.3	Target Beneficiaries .....	9
B.4	Project Strategy and Implementation Arrangements .....	10
B.5	Reasons for Assistance from UNDP .....	14
B.6	Special Considerations .....	14
B.7	Coordination Arrangements .....	15
B.8	Counterpart Support Capacity .....	15
<b>C</b>	<b>DEVELOPMENT OBJECTIVE</b> .....	<b>16</b>
<b>D</b>	<b>IMMEDIATE OBJECTIVES, OUTPUTS AND ACTIVITIES</b> .....	<b>16</b>
	Immediate Objective 1 .....	16
	Immediate Objective 2 .....	18
	Immediate Objective 3 .....	21
	Immediate Objective 4 .....	24
	Immediate Objective 5 .....	27
<b>E</b>	<b>INPUTS</b> .....	<b>28</b>
<b>F</b>	<b>RISKS</b> .....	<b>32</b>

G	PRIOR OBLIGATIONS AND PRE-REQUISITIONS .....	34
H	PROJECT REVIEWS, REPORTING AND EVALUATION .....	34
I	LEGAL CONTEXT .....	35
J	BUDGET .....	35
	ANNEX 1: WORKPLAN.....	39
	ANNEX 2: OUTLINE TOR FOR SUBCONTRACTS .....	40
	ANNEX 3: TOR FOR CONSULTANTS .....	65
	ANNEX 4: OVERSEAS TRAINING.....	82
	ANNEX 5: IN-COUNTRY TRAINING .....	88
	ANNEX 6: EQUIPMENT .....	95
	ANNEX 7: DESCRIPTION OF INCENTIVE PROGRAMS .....	96
	ANNEX 8: PROJECT STRATEGY SCHEMATIC .....	110
	Attachment 1: Capacity Building for National Execution.....	103
	Attachment 2: Incremental Cost/Benefit Table.....	110
	Attachment 3: Project Planning Matrix.....	113

## A Context

### A.1 Description of Sub-sector

In 1996, consumption of energy in China exceeded 1.2 billion tonnes of coal equivalent (tce), making China the second largest energy user in the world after the United States. This has been growing at an average annual rate of over 5% per year since 1985. China's primary source of energy is coal, which currently accounts for approximately three quarters of commercial energy use and eighty percent of electricity generation. Electricity consumption is growing even more rapidly than total energy use.

This growing energy use and this predominant dependence on coal are leading to substantial increases in CO<sub>2</sub> emissions and in local environmental and health problems. For example, due largely to fossil fuel burning, China is set to become the largest country source of CO<sub>2</sub> emissions by 2020. Also, pulmonary disease, which is closely related to air pollution from coal burning, is the largest single cause of adult deaths in China, accounting for 26% of adult deaths. Air pollution from fossil fuel power generation also contributes to acid rain, which causes serious damage to forests, crops, and aquatic life throughout China.

In 1995, electricity production was responsible for one-third of China's CO<sub>2</sub> emissions. From 1980 to 1995, residential power use rose from three percent to twelve percent of total electricity consumption, growing at an annual rate of 16.3 percent over the period. This growth has been driven by an explosive increase in household appliance use as household income has risen dramatically over this period. Within the residential sector, it is estimated that refrigerators alone, now found in 70% of urban households, account for approximately half of all residential electricity consumption. In 1992, there were a total of 39 million refrigerators in service, up from only 4 million in 1985 (38% average annual growth). By 1996, the number of refrigerators in service is estimated to have surpassed 60 million. To summarise, refrigerators in households in China are making significant and growing contributions to emissions of CO<sub>2</sub> and local environmental problems.

Production of household refrigerators in China has doubled since 1990, rising from 4.63 million units in 1990 to 9.28 million in 1996, second highest in the world. During this same period, the industry has undergone significant consolidation, with the number of producers falling from over 100 to 30 in 1996. In 1996 twelve Chinese firms alone accounted for 89% of production and 88% of total refrigerator sales of 9.3 million. Rising production and sales has also resulted in a rapidly growing stock of refrigerators.

Refrigerators are penetrating urban markets rapidly. According to a recent survey report, the majority of future sales are likely to come from economically developed urban and affluent rural areas. In mature urban markets, over half of refrigerator purchases will be for replacement units, while "second tier" urban markets — provincial capitals and other smaller urban areas — still represent large markets for first-time purchases.

At current levels of power consumption and production levels, refrigerators produced in China over the next decade will require an additional 601 billion kWh of energy over their expected lifetimes, equivalent to an annual average of 60 million tons of additional CO<sub>2</sub> emissions. This would necessitate an estimated increase in an annual power generation capacity of 5,700 MW, requiring increased investment of over US\$5 billion in 1995 terms. If production levels increase, as they are expected to, additional power generation capacity required will be significantly higher, and CO<sub>2</sub> emissions correspondingly higher.

Clearly refrigerators are to use considerable quantities of electricity in the coming years. Increasing the energy efficiency of these refrigerators will therefore save electricity, cut pollution and greenhouse gases, and cut public investment requirements, thereby freeing monies for other public investments (eg in poverty alleviation). However, on average, Chinese refrigerators are significantly less efficient than those produced in the European Union, United States, or Japan. There is a clear need to strengthen capacity in China to manufacture and utilise energy efficient refrigerators.

## A.2 Host Country Strategy

China is a party to the Framework Convention on Climate Change, and is in the process of formulating policies to address global climate change concerns. Several studies have been undertaken, including UNDP/WB/Government study on *Issues and Options For GHG Emissions* funded by the Global Environment Facility (GEF) and one by the Asian Development Bank (ADB/SSTC, 1994). These studies urge that programmes to increase energy conservation and efficiency be implemented. The UNDP/WB/Government study concluded that, given the rapid growth in the Chinese consumer sector, improvements in the energy-efficiency of household appliances (such as refrigerators) was an area which could yield major energy savings for the economy while at the same time eliminating substantial carbon emissions.

Strengthening the energy sector is a priority for the Chinese leadership. This includes major policy initiatives and investments in the renewable energy sector (supply), as well as initiatives to manage demand for electricity.

In order to decrease the dependence on fossil fuels and coal in particular, the Government has developed policy and is investing heavily in hydro-power, wind, solar and other renewable energies. The State Economic and Trade Commission (SETC), the State Development and Planning Commission (SDPC) and the State Science and Technology Commission (SSTC) recently prepared a "*Program on New and Renewable Energy Development in China (1996-2010)*", which aims to rapidly expand the use of these energy sources throughout the country.

Energy efficiency in the electricity sector features prominently in a number of strategy documents: the China's Ninth five-year Plan (1996-2000) for economic development and China's Agenda 21. Notably, in November 1997, the National People's Congress approved the *Energy Conservation Law* to promote energy conservation throughout society, improve efficiency of

energy utilisation, achieve economic benefits and protect the environment. In line with this, the Government has launched major programmes to promote efficient lighting, efficient air conditioners and more efficient management in power plants.

In line with the ongoing transition to a market economy, the government is developing and experimenting with new tools and mechanisms to improve efficiency in the sector and ensure an appropriate incentive framework. These include deregulation, introduction of joint ventures, Independent Power Purchasers (IPP), energy service companies (ESCO), etc

Environmental protection is also a priority for the Government, and a comprehensive legal and administrative framework has been implemented. This includes the *Environmental Protection Law* (1979, 1989), *Air Pollution Prevention and Control Law* (1987, amended in 1995), *Agenda 21*, and the recent strengthening of the State Environmental Protection Agency. The focus is on industrial and urban pollution, and has been on end-of-pipe treatment and 'command and control' measures. Recent measures are more prevention and market oriented, including for example increasing public awareness and providing regular data on the air quality in cities and localities in China.

More specifically, in the refrigerator sector, energy efficiency in this sector has been identified as a focus in the Country Plan for CFC phase-out, the CFC Substitute Strategy for the Chinese Refrigerator Industry, and is a component of the National Plan of Environmental Protection for China.

### A.3 Prior or Ongoing Assistance

International assistance to the energy sector has been a priority in China over the past decade. Within the framework of UNDP's environment and energy programme, there are several projects aiming at both supply and demand management. These include *CPR/96/311, Capacity Development for China's Green Light Programme; CPR/96/312, Management and Energy Efficiency in the Electric Power Industry; CPR/96/313, Capacity Development for Fuel cell Powered Buses Development and in Commercialisation China* and *CPR/97/G31, Capacity Building for the Rapid Commercialisation of Renewable Energy*. These projects aim to facilitate China's transition to a market-oriented economy in the energy sector, to cut investment requirements, to reduce pollution. In each case, economic, financial, institutional and informational barriers to technologies or approaches are removed.

More specifically in the refrigerator sector, in recent years a number of donor-funded technical-assistance projects for technology in China have been initiated. UNDP, under the Montreal Protocol, is also implementing eight projects for CFC replacement in the refrigerator sector, and the World Bank has approved and initiated implementation of a number of projects.

#### US-China Refrigerator Project:

In 1989, the US-China Refrigerator Project was initiated as a joint project to combine non-CFC refrigerant, non-CFC foam, and increased energy efficiency. In 1990, USEPA established a cooperative agreement with the Beijing Household Electric Appliance Research (BHEARI) for a three year period to build institutional capacity at BHEARI and initiate research and development of energy-efficient substitutes for the CFCs used in Chinese household refrigerators. Work undertaken by BHEARI and the University of Maryland using modified versions of current production models demonstrated that by introducing new energy-efficient design measures, cost-effective energy savings of 40-50% can be obtained while at the same time maintaining low incremental manufacturing costs and minimizing price increases to consumers, thereby promoting a win/win situation.

#### Montreal Protocol Fund:

The Montreal Protocol Executive Committee approved funding for continued prototype development in June 1993. Subsequent work in 1993 and 1994 focused on construction and continued refinement of advanced prototype units. USEPA served as a collaborating agency on this project.

China selected the Haier Group of Qingdao for final prototype development, and an initial batch of 200 intermediate prototypes were built in December 1993 using thick-walled HFC-141b insulation and HCFC, HFC, and hydrocarbon refrigerants and refrigerant mixtures. Based on testing of these prototypes and international progress in movement to zero ODP foam blowing agents, final prototypes were produced in early 1995 using cyclopentane foam and isobutane refrigerant. These prototypes were field tested in 1995 and 1996 in Beijing, Shanghai, and Guangzhou, and demonstrated substantial savings (35% in Shanghai) in actual home use conditions. An agreement was reached between USEPA and the German GTZ to jointly fund the Montreal Protocol portion of the prototype conversion, which was approved by the Montreal Protocol Executive Committee in March 1995, thus achieving the synergy between CFC phase-out and energy efficiency improvement.

Other Montreal Protocol Fund projects in China have been implemented by the World Bank, UNIDO, and UNDP.

#### World Bank:

The World Bank has served as implementing agency for the Montreal Protocol for most of the CFC conversion projects at refrigerator factories in China. This includes technical assistance and capacity building for foam testing, early conversions to 50%-reduced foam at Changling, Haier, Shangling, Shuangyuan, Xinfei, and foam and/or refrigerant replacement at Changling, Huayi, Shangling, Shuanglu, Xiling, Wanbao, Zhongyi, and other factories.

#### UNIDO:

UNIDO has supported the preparation and implementation plans for CFC conversion projects at six Chinese compressor manufacturers in order to provide a domestic source for compressors for

non-CFC refrigerators. These manufacturers include Jiaxipera, Huangshi, Wanbao, Zanussi, and Embraco. At Jiaxipera factory in Zhejiang and Wanbao in Guangdong, research has been ongoing on new efficiency measures and new technology options to increase the average efficiency of their models, which currently stands about 1.1 COP. US-China Refrigerator project activities have encouraged and supported this research.

#### UNDP:

UNDP has served as implementing agency for CFC phase-out at Guangdong Kelon, Changsha Zhongyi, Henan Polar Bear, Qingdao Haier, Hongxiang Laizhou, Debao Freezer, Wanbao Freezer, and Jilin Freezer.

#### Australia Compressor Factory Project Loan:

In 1990-91, AusAID provided A\$14.6 million for the conversion of the Huayi General Electric Company in Jingdezhen, Jiangxi. The project involved the provision of expertise, technology, machine tools and equipment to build a CFC-free refrigerator/freezer compressor factory with a design capacity of 1 million units per year. Construction took place from Dec. 1991 to 1993 and the plant went into trial operation in 1994.

Finally, the \$243, 000 PA/PDF of this project prepared a technical basis to formulate this proposed project. A Refrigerator and Compressor Sector Survey was conducted, providing general information on production levels, technologies used and energy consumption in the Chinese refrigerator and compressor sector. Market Research was carried out, including a survey and analysis of market potential for energy-efficiency refrigerators in China. Other major outputs of the PDF project, such as Compressor Efficiency Upgrade Report, Training Proposals, Energy Efficiency Standard Revision Proposal and Incentive Program, are the basic documents to support the design of the present project.

#### A.4 Institutional Framework for Sub-sector

The following agencies and organizations are the principle organizations involved in the Chinese refrigerator sector :

- The China State Environmental Protection Agency (SEPA), which is responsible for all aspects of environmental policy, the formulation of national environmental regulations and issuance of national environmental quality standards. SEPA is entrusted by State Council for the enforcement of regulations and standards and coordination of important environmental programs and projects. SEPA is also responsible for environmental labeling programs;
- State Administration of Light Industry (SALI) – formerly the National Council for Light Industry - is responsible for all aspects of light industry. It is entrusted by State Council to formulate and enforce national policies for light industry, such as the long and medium



term development programs. It is also plays a supervisory role over the refrigerator industry;

- The State Economic and Trade Commission (SETC) is in charge of industrialization and retrofitting existing industries. In 1987 the department of Resources Comprehensive Utilization and Conservation was established within SETC to provide policy-making and project support to energy saving state programs, with primary responsibility of project identification and financial arrangements. SETC has counterpart provincial (PETC) and county-level agencies to help direct and implement policy;
- The China Household Electric Appliance Association (CHEAA), is entrusted by the government to formulate and enforce development programs for household electric appliances, provide consultation for government agencies, enterprises and other entities concerned. It is also responsible for an informal association within the household electric appliance industry and serves as a management and coordination entity in household electric appliance industry;
- China State Bureau of Technical Supervision (CSBTS) is a functional department carrying out unified administration of the whole country's work in the field of standardization, metrology and quality control. It is responsible for implementing the laws and rules on standardization, coordinating and guiding the standardization work carried out by ministries and local areas;
- The China Household Electric Appliance Research Institute (CHEARI) performs national consumption and performance testing and appliance research and development activities; and,
- China's State Administration of Internal Trade (SAIT) is entrusted by China's government to execute administrative function related to management and coordination in the field of internal trade. It is responsible for the formulation and enforcement of development programs and statistical data collection in internal trade.

## **B Project Justification**

### **B.1 Problems to be addressed: The Present Situation**

The overall problem to be addressed by the project is excessive energy use by household refrigerators produced and utilised in China, which leads to CO<sub>2</sub> emissions and local environmental and health impacts, particularly in urban areas. This is due to a market structure which impedes the development of the energy efficient refrigerator sector.

The key barriers to adoption of energy efficient refrigerators by households are:

*1. Lack of awareness of the lifecycle economic benefits of high-efficiency refrigerators.* Consumers remain highly sensitive to the first-costs of their purchases and, inappropriately (from an economic viewpoint), prefer models with low purchase prices and higher electricity costs because they do not fully appreciate that total lifecycle costs, including electricity, can be much lower for high-efficiency models.

2. *Lack of reliable, comparative information available to consumers about specific models.* Even if consumers want to purchase models with low lifecycle costs, they are unable to make comparisons between models because labels do not exist which provide such information in a consistent and easy-to-understand manner. Existing labels that have appeared recently on some models in some markets lack national certification based on national energy-efficiency criteria and provide inadequate information to reliably judge performance. This has led to consumer confusion and growing government concern over proliferation of multiple criteria.

3. *Manufacturer uncertainty about market demand for high-efficiency models.* Manufacturers have had access to few, if any, market research studies or data about the potential demand for high-efficiency models in the Chinese market, partly because historically low electricity prices and little emphasis on energy efficiency in the Chinese economy left both producers and consumers uninterested. Only recently, with rising electricity prices, more disposable income among a growing segment of Chinese society, and a greater emphasis on competitiveness in industry, has consumer attention turned to high-efficiency products.

4. *Manufacturer uncertainty about cost-effectiveness of high-efficiency models.* Manufacturers are uncertain about the costs of developing and producing high-efficiency models, and about the price premium in the marketplace that high-efficiency models might command. Therefore, the cost-effectiveness from a manufacturing perspective is uncertain and manufacturers are reluctant to commit the resources to develop and produce high-efficiency models.

5. *Lack of expertise in energy-efficient refrigerator design.* The majority of Chinese manufacturers lack the engineering and design expertise to develop new energy-efficient refrigerator models or modify existing designs to make them more energy efficient. Issues such as cycle optimization and designing for efficiency have been of little importance in the design of household refrigerators. As a result, manufacturers have not cultivated the skill necessary for energy efficient refrigerator design. Second, most domestic manufacturers have relied heavily on imported or licensed technology at some stage of their development (and some continue to do so), and are therefore at a further disadvantage in developing new energy efficient product designs. Finally, many domestic manufacturers (and particularly second tier ones) have in the past relied on a limited and unchanging product line for their sales, and therefore have extremely limited experience in product design and redesign. For these reasons, many manufacturers are uncertain of their ability to move in new technology directions in the implementation of energy-efficiency measures without targeted training to impart the necessary skill sets.<sup>1</sup>

6. *Higher-efficiency compressors are not available domestically.* In order for a Chinese refrigerator manufacturer to design and produce a high-efficiency model, a higher-efficiency compressor must be utilized. Currently such compressors are not available domestically; the

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<sup>1</sup> A similar technical barrier exists for Chinese compressor manufacturers, given the historic reliance on imported product designs and product licensing.

higher cost of imported high-efficiency compressors is a strong disincentive for domestic refrigerator manufacturers.

7. *Dealer reluctance to stock or promote high-efficiency models.* Uncertainty about consumer demand, the need to educate their sales force, and fear of reduced sales due to higher prices on the shelves all make dealers reluctant to stock high-efficiency models. Survey results have also indicated that sales staff are uneducated on the benefits of energy efficiency and unable to provide consumers with reliable information.

8. *Lack of an appliance recycling program.* Lack of an appliance recycling program means that often unnecessary refrigeration is occurring. As China's refrigerator market matures, an increasing proportion of purchases involve replacement of an old refrigerator. Unlike most developed countries, where most old appliances are scrapped or recycled, market research indicates that 50% of new buyers in China will keep their old refrigerators. The old refrigerators maintained in use, however, may offset much of the efficiency gains from the purchase of new refrigerators, depending upon the extent to which they are operated.

9. *Lax efficiency standards.* Experience in countries adopting mandatory efficiency standards has proven them effective in removing the most inefficient models from the market and in creating expectations of periodic increases in minimum energy performance standards. China's current efficiency standards, promulgated in the 1980s, were established in view of the needs of hundreds of small refrigerator producers. They are currently outdated in view of the consolidation of the industry and increase in technical expertise of companies, and provide no incentive to companies to increase the energy efficiency of their models.

## **B.2 Expected End of Project Situation**

The following is expected to take place as a result of the project:

1. Consumers will have greater awareness of the lifecycle economic benefits of high-efficiency refrigerators. Extensive public education, informational material distributed at points of sale, new energy-efficiency labeling, and trained dealers will all contribute to consumer education and increased awareness.
2. Consumers will have more reliable, comparative information available to assist them in their purchase decisions. New nationally certified labels developed in conjunction with revised minimum efficiency standards will allow consumers to compare the energy-efficiency of different models and brands of refrigerators.
3. Manufacturers will have increased confidence about the market demand for high-efficiency models. Educational programs for consumers, training and incentive programs for retail staff, and a mass purchasing program will provide manufacturers with greater certainty of market demand for energy-efficient products.

4. Manufacturers will have increased certainty about the cost-effectiveness of high-efficiency models. Greater consumer awareness of the life-cycle benefits of energy efficiency will strengthen their current willingness to pay additional for energy-efficient refrigerators, allowing manufacturers to recover the increased costs, domestic manufacturing of energy-efficient compressors will reduce the costs.

5. Manufacturers will have greater expertise in energy-efficient refrigerator design. Intensive design training, assistance in technology selection, and training in computer modeling will substantially increase manufacturers' ability to design energy-efficient refrigerators.

6. Higher-efficiency compressors will be available domestically. Applied design training and in-house technical assistance will increase compressor manufacturers' capacity to design and market energy-efficient compressors.

7. Dealer will be willing to stock and promote high-efficiency models. Training of retail staff in marketing of energy-efficient products, supplemented by retail sales incentives, will assure dealers that energy-efficient refrigerators are a desired stock item.

8. China will have experience with developing an appliance recycling programs. Preparation of a feasible appliance recycling program will provide China with the basis to implement a recycling program in one city and replicate it nationally.

9. Appliance energy efficiency standards will be improved. Training in the methodology and analysis of the refrigerator standards revision will build capacity to revise China's refrigerator standards and implement stricter minimum efficiency standards.

### **B.3 Target Beneficiaries**

The China Refrigerator Project will have direct and indirect beneficiaries. The direct beneficiaries in the project are listed and described below:

*Local agencies and institutions.* The project will benefit the government agencies and non-governmental institutions and organizations involved in the project by creating capacity for implementation of this project and for development and implementation of similar projects in the future. The project will also increase the awareness in policy circles about the importance of energy efficiency and climate change mitigation.

SBTS, SALI, SETC, SEPA and other relevant institutions will all develop appropriate capacity to implement market-oriented government programmes which promote socially and economically useful products.

*Compressor manufacturers.* All major domestic compressor manufacturers will receive initial training and exposure to best international practices. Next, those most committed and most

likely to be competitive, will be assisted to develop new business and investment plans, and to implement those plans.

*Refrigerator manufacturers.* The project will transfer energy efficiency design options to Chinese refrigerator manufacturers and support implementation of energy efficiency measures in existing and new product designs. As for compressors, all manufacturers will receive initial training and exposure to international best-practices. Those major manufacturers that demonstrate a commitment to energy efficiency will then receive intense training in model design, business development and marketing to develop and produce energy efficient models.

*Consumers.* Consumers will benefit from the increase information, the increased choice of refrigerators on the market, and eventually the reduced electricity bills.

*Dealers.* Under the project, dealers will become educated about high-efficiency refrigerators so that they can provide information to consumers at the point-of-sale. In addition, dealer-incentive programs will encourage dealers to stock high-efficiency refrigerators. Pilot programme will first be run with a select group of dealers.

Indirect and long-term beneficiaries of the project include:

- urban and rural Chinese residents that benefit from high-quality refrigeration at a lower energy cost;
- urban and rural residents that benefit from reduced local pollution and its adverse health impacts;
- residents of impoverished areas that are benefited by potential reprogramming of funds that would otherwise have been invested in increased power supply, but are as a result of the project freed up to meet other urgent social and humanitarian needs; and all beneficiaries of reduced climate change, particularly in small island nations and coastal areas

## **B.4 Project Strategy and Implementation Arrangements**

### **B.4.1 Strategy**

In line with GEF requirements, *all* barriers to energy efficient refrigerators will be removed. This is very ambitious target, however the government has already launched significant related activities. Underlying the strategy of this project is that it will complement, support, and where appropriate provide guidance to these ongoing national initiatives.

The project is to effect a transformation of China's refrigerator market through the reduction and elimination of technical, market, commercial, informational and other barriers to the production and marketing of energy-efficient refrigerators. The activities developed for this project can be generally grouped into those providing a "technology push" - increasing the supply of energy efficient refrigerators; and those providing "demand pull" by raising retailer and consumer understanding of the benefits of energy efficient refrigerators. A diagram illustrating this overall project approach is provided in Annex 8.

## Technology Push

The project will significantly increase the efficiency of household refrigerators in China by pushing existing and commercially proven<sup>2</sup> energy efficiency technologies.

First, given that energy-efficient compressors are an integral component of energy-efficient refrigerators, the project includes a range of activities aimed at compressor manufacturers. Through international design training, business planning, technical assistance and some technology transfer, the project will assist compressor manufacturers to upgrade their products. An incentive programme will provide incentives and fund the incremental costs to manufacturers of producing energy efficient compressors. (see Annex 7 for details of this incentive programme and how it will be implemented.)

At the same time, focused training activities aimed at the refrigerator manufacturers will build their capacity to design and manufacturer energy efficient refrigerators. Computer design modeling, international technology training, tours and exhibitions, and intensive energy-efficient design training will provide refrigerator manufacturers with the tools to create new energy-efficient model designs. To provide the incentives to design and implement efficiency gains, manufacturers will compete through a bidding process for incentive program awards. (See Annex 7 for details of this incentive programme). The move to energy-efficient designs will be further sustained by the implementation of new minimum energy efficiency standards and the establishment of periodic revisions to the standard.

It should be noted that the efficiency measures promoted are not design-specific; i.e., manufacturers can chose from a range of non-patented measures not limited to a particular refrigerator design to increase efficiency. In this sense, the proposed approach to increasing refrigerator energy efficiency is design-intensive rather than capital-intensive. By building on past achievements, the project ensures lower costs, easier implementation, broader participation, and avoids challenges and potential technology uncertainties and costs associated with the use of patented or licensed proprietary technology.

The project will also strengthen energy efficiency standards. In testing adherence to standards, ISO methodologies will be used for measurement, testing and calculation of energy consumption. As a first step of this initiative, during the PDF phase, the Chinese project participants have revised the old energy efficiency standards by adopting ISO testing procedures currently in use in most countries. During this proposed full GEF project, a new round of stricter minimum efficiency standards setting will be conducted. ISO testing procedures and calculation methodology will be explicitly included in the development of these new standards. Assistance and training in the analytical tools to determine the new standards will be provided to build national capacity.

## Demand-pull

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<sup>2</sup> These technologies are non-proprietary.

Demand-pull activities include a number of programs designed to reduce barriers to consumer and dealer acceptance of energy-efficient refrigerators. Consumers are becoming more conscious of energy expenditures because of rising residential electricity price and expectations of further increases. As stated in the Market Survey conducted during the PDF phase of this project in 1997, there is no longer a big difference in terms of basic product functions, and other criteria, such as energy efficiency, are becoming increasingly important. After reliable post-purchase service, energy efficiency is now the most sought-after feature. In addition, consumers indicated that they are now willing to pay more (up to 15% more according to the survey) for a refrigerator with 40% more efficient in energy consumption than the models currently found in the market. These trends offer significant opportunities for improving the energy efficiency of Chinese domestic refrigerators. Although consumer attitudes have become more increasingly favorable to the marketing of energy-efficient refrigerators, they remain highly sensitive to first costs and are unaware of or underestimate life-cycle benefits.

To generate demand and increase consumers' understanding on the benefits of high-efficiency refrigerator, a Consumer Education Campaign will be carefully designed, using TV and other media. Consumers will also be targeted with relevant educational and informational materials to reduce first-cost barriers to purchase, and to increase their confidence in the quality of information available on energy-efficient refrigerators. To complement this Campaign, public activities, documentaries and journal articles will be commissioned to educate the public on the benefits of energy efficiency. In addition, a nationally certified energy label will provide comparable information across models to allow consumers easily identify energy efficient refrigerators.

Retail staff will be trained in the understanding and promotion of energy efficiency. An incentive programme with retail staff will encourage sales of energy efficient refrigerators in the key markets of China. (see Annex 7 for details of this incentive programme). As consumers rely on retail staff for their final selection of a refrigerator, staff training will be supplemented by the distribution of additional printed information detailing the economics of energy efficiency and comparing energy-efficient to non-efficient models .

In the meantime, in order to reduce the commercial risk to manufacturers for producing energy-efficient refrigerators, a mass purchasing program will be designed and launched. Such a program takes advantage of the lower unit costs and higher purchasing power available to mass purchasers, such as apartment buildings, government units, military units, and other bulk providers of refrigeration. Competitive bids to manufacture and sale large quantities of energy-efficient refrigerators will provide manufacturers with greater assurance of market demand.

Many individual consumers in China are purchasing 'second' refrigerators. Hence (under parallel financing), a recycle/buyback program providing financial incentives to consumers to return old refrigerators on the purchase of a new energy-efficient ones will be developed.

One of the main goals of this project will be to demonstrate the win/win nature of energy efficiency investments to manufacturers, dealers and consumers so as to ensure private sector sustainability of the project approach beyond the period of GEF support. This will in turn build a good basis for the implementation of the Government's energy efficiency policy. Finally, energy efficiency standards and labels developed through the project could also contribute to further development of similar economic instruments for other product types, such as air-conditioners, microwaves, water heaters or other appliances. This will build a long-term impact on energy-efficiency advancement in home appliance sector in China.

#### B.4.2 Implementation Arrangements

The project will be nationally executed by the State Environmental Protection Administration (SEPA). The Executing Agency will be responsible for the overall planning and management of the project. It will be accountable to UNDP for the optimal use of UNDP/GEF resources and the achievement of project objectives.

The implementing agency is the Foreign Economic Cooperation Office of SEPA, and technical cooperation will be provided by the United Nations Department for Economic and Social Affairs (DESA) as determined through a letter of cooperation. The State Administration for Light Industry (SALI) will provide technical support to implementation. The implementing and cooperating agency will be responsible for procurement and delivery of project inputs and organization of project activities. FECO will appoint the National Project Director (NPD) and SALI will appoint a Deputy NPD. The SALI will assist FECO in organizing project activities, in particular, to assist in coordination with local enterprises in the compressor and refrigerator sector.

A Chinese Advisory Committee (AC) will be established to include officials from SEPA, SALI, the State Bureau of Technical Supervision, the State Administration of Internal Trade, among others. The AC shall meet twice a year. The AC will review and comment upon project outputs, provide guidance to the project at a macro-level, and help disseminate project findings and outputs. The AC will also ensure that, where appropriate, the general approach developed under this project can be applied to other electric products.

Day-to-day project management and coordination will be under the direction of the Project Management Office (PMO), staffed by a full-time National Program Advisor, an International Program Advisor, representatives from SEPA, FECO, SALI, and financial and administrative staff. The PMO will help prepare quarterly financial and planning reports. These reports will be approved by FECO and certified by the Executing Agency. The PMO shall prepare all work plans, semi-annual and annual progress reports and acts as secretariat to the AC.

To facilitate project management, the project is designed to rely heavily on sub-contracts to implement activities and deliver outputs. Sub-contracts will be issued, via competitive bidding, by either the national implementing agency or DESA. The budget in Section J identifies which agency shall be responsible for each sub-contract. TOR for the sub-contracts is provided in Annex 2.



### **B.5 Reasons for Assistance from UNDP**

Environmental protection is a priority for UNDP, along with poverty alleviation, governance, job creation and women's participation. This project will address environmental issues at both local and global levels. The local environmental benefits will be primarily in terms of reduced air pollution. The health benefits from reduced pollution will improve the quality of life of millions of Chinese in rural and urban areas. At a global level, the project will support China in its efforts to reduce GHG emissions, to mitigate climate change and thereby contribute to China's standing as a global citizen.

As spelled out in the foreword to the 1997 UNDP publication Energy After Rio: Prospects and Challenges "Agenda 21 called on nations to find more efficient systems for producing, distributing and consuming energy. UNDP through its Initiative on Sustainable Energy is assisting programme countries to reflect these objectives in national energy policies, investment plans and sustainable development strategies." The objectives, strategies and expected outcomes of this project do much to advance the goals of the Initiative on Sustainable Energy, and are in line with UNDP's global strategy.

The project will also contribute to the UNDP objective of poverty alleviation. By reducing the growth in the demand for electricity, the project will release public funds that otherwise would have been invested in electricity generation. These funds can be invested into socio-economic and poverty alleviation projects.

One of the major components of the project is capacity development of Chinese professionals. A large group of national experts, as well as the Chinese investment and business community, will be trained. This will ensure that the process started with this project will be sustained and disseminated in the country.

### **B.6 Special Considerations**

The project will create a positive environment for greater participation of the private sector, particularly the domestic, in this growing sector of the Chinese economy. The project will directly contribute to strengthening the private sector in this transitional economy.

The project will seek to ensure that at least 30% of all training participants are women.

The project will complement China's Country Plan for CFC phase-out for this sector under the Montreal Protocol. Under the Montreal Protocol, funding for energy efficiency improvements is not permitted. However, by taking advantage of the synergy available through targeting those manufacturers currently planning to undergo CFC conversion with Montreal Protocol Fund support, energy-efficiency improvements of up to 40% or more can be realized, duplication of

effort is avoided, and global environmental benefits are enhanced in a more cost-effective manner.

### **B.7 Coordination Arrangements**

As the lead agency for environmental protection, the SEPA (Executing Agency) will ensure the project activities are coordinated with all related environmental activities. Likewise, the SALL will ensure that the project complements all related government and private sector initiatives in the refrigerator sector. This is particularly relevant to the development of standards and labels.

The AC will ensure coordination at a macro-level with ongoing developments in China, particularly at the policy level.

The UNDP Country Office in Beijing will help ensure coordination with other UNDP and MP projects, particularly those targeting the energy sector.

At a day-to-day level, the PMO will ensure that activities (training, seminars, reviews) are coordinated with other similar activities. The PMO is also responsible for coordinating all project inputs. The PMO, further described in section 2.4 above, will be responsible for the coordination of project activities by Chinese firms and agencies and the activities of international experts. All information prepared under the project will be disseminated by the PMO and the Project Information Centre.

### **B.8 Counterpart Support Capacity**

SEPA has the capacity to execute national projects of this scale, as proven by its implementation and execution of other GEF, ADB, World Bank and Montreal Protocol projects. SEPA has the overall mandate for environmental protection and is the technical agency for all GEF projects in China.

Within SEPA, FECO is executing several international projects, including the WB environmental loan project, Montreal Protocol projects and some bilateral projects. The FECO of SEPA (FECO) has a professional team of more than 70 highly educated and qualified staff. There are eight divisions within FECO:

- Division 1: World Bank and ADB Operation
- Division 2: Bilateral Cooperation
- Division 3: Montreal Protocol Multilateral Fund
- Division 4: GEF
- Division 5: Procurement
- Division 6: International Liaison

- Division 7: China Council for International Cooperation on Environment and Development (CCICED)
- Division 8: Planning and Finance

However FECO's roster of international agencies and experience in procuring international services is limited. Therefore FECO will call upon the services of UNDESA to identify and procure such services through a cooperation agreement. (See Attachment 1 for an internal assessment of FECO's capacity to execute and implement UNDP projects.)

SALI has the mandate and technical coverage of the refrigerator sector, and has a broad outreach amongst the refrigerator and compressor manufacturers. SALI has experience in the implementation and management of MP refrigerator projects. SALI is therefore ideally situated to support SEPA technically.

## C Development Objective

The development objective of this project is to reduce CO<sub>2</sub> and other greenhouse gas emissions in China by removing barriers to wide spread commercialization of energy-efficient refrigerators in China.

## D Immediate Objectives, Outputs and Activities

Many of the activities listed are very substantial. For such activities, further details on the activity is provided in the appropriate annex.

### Immediate Objective 1

**Develop capacity to provide a "technology push" for increasing the supply of energy efficient compressors**

#### 1.1 Output 1:

Technical capacity to design energy-efficiency compressors established.

#### Success Criteria

*The success of this effort will be indicated by the participation and training of 16 staff from Chinese compressor manufacturers in international design training workshop and study tour.*

Activity 1.1.1: Develop selection criteria and select major compressor factories to participate in overseas training and incentive programme bidding (PMO, Intn't and natn'l compressor expert)

Activity 1.1.2: Intensive in-country training for 32 staff from the selected compressor factories

Focus of training will be on the principles and application of high-efficiency compressor design, including modifications to existing and planned compressor designs to increase compressor efficiency. [Subcontract 1]

#### Activity 1.1.3 Undertake overseas study tour

Training of 1.1.2 will be followed by an overseas study tour (to Europe and North America) on international compressor efficiency research, development, and production facilities. 16 staff will be trained. [PMO] See annex 4a

#### 1.2 Output 2:

Business plans to upgrade production of energy-efficient compressor developed in leading compressor manufacturers.

#### Success Criteria

*Indicators of success is the development of manufacturer production plans for energy-efficient compressors.*

#### Activity 1.2.1: Hold meeting to facilitate dialogue between compressor and refrigerator manufacturers to assure compressor manufacturers that demand for high-efficiency compressors will exist.

Refrigerator and compressor manufacturers will participate in a meeting to review and discuss future needs for higher efficiency compressors, particularly in view of revised national refrigerator efficiency requirements and refrigerator manufacturer production plans. The meeting will also introduce the compressor incentive scheme to all potential participants. [PMO]

#### Activity 1.2.2: Prepare incentive programme bidding proposals and business plans

Compressor manufacturers will be supported in developing business plans and financing proposals to upgrade designs and production technologies. International and domestic experts will work with manufacturers to promote incorporation of energy efficiency measures into current and planned projects, assist in the preparation of business plans and financial analysis for upgrading and production of energy efficient compressors, and assist in preparation of bids for the award of technical assistance in factory upgrade as described in Activity 1.3.1. This activity will take place in parallel with Activity 2.2.1. [International compressor expert; Domestic compressor expert]

#### 1.3 Output 3

Upgraded manufacturing capacity in competitive compressor manufacture

#### Success Criteria

*Selection of two compressor manufacturers for further technical assistance in the production of energy efficient compressors. Improvement of energy efficient of compressors by 20%.*

#### Activity 1.3.1: Select participating compressor factories

Based on bid prepared under 1.2.2, two compressor manufacturers will be selected and each awarded half of the compressor upgrade incentive funding . See Annex 7 for further details of the selection criteria and process. [PMO, Bid Evaluation Committee]

#### Activity 1.3.2: Provide on-site training to selected compressor manufacturers for upgrading designs and production technologies

Compressor manufacturers selected in Activity 1.3.1 will receive technical assistance in preparing design and production plans for energy efficient compressors. International and domestic experts will provide assistance in evaluating research and development and international technology transfer options. [International compressor expert; Domestic compressor expert]

#### Activity 1.3.3: Upgrade compressor designs and production technology

Manufacturers selected under the bidding process in Activity 1.3.1 will develop and/or acquire new energy efficient product designs and, where necessary, upgrade or modify production technology and production equipment in order to manufacture energy efficient compressors. Where internationally provided technology is identified as the most cost-effective option, support for procurement will be provided. The bulk of the cost of this activity will be covered by the manufacturers themselves; the GEF funding component under this activity will partially cover the activity's incremental cost. [Selected compressor manufacturers].

### Immediate Objective 2

**Develop capacity to provide a "technology push" for increasing the supply of energy efficient refrigerators**

#### 2.1 Output 1

Capacity at all refrigerator manufacturers developed to model and evaluate energy efficiency options, and introduction to international energy-efficiency technology options.

#### Success Criteria

*Success in this objective will be achieved when all manufacturers have received training in international technology options and computer modeling of energy-efficiency measures in refrigerators.*

#### Activity 2.1.1: Hold seminar and exhibition in China on refrigerator technology options available internationally

In conjunction with the international appliance conference held in China biannually by SALI, all refrigerator manufacturers will be invited to participate in a seminar and exhibition to introduce manufacturers to energy efficient design principles and showcase energy efficient

technologies currently available internationally. Topics covered in the seminar will include testing procedures, refrigerant properties, foam blowing agents and insulation materials, flammability issues for flammable refrigerant and foam blowing agents, heat-leak testing, calorimeter testing, energy consumption testing, cycle component improvements, cabinet improvements, heat exchanger improvements, manufacturing concerns, and advanced cycles. See Annex 5a [PMO]

2.1.2 Hold workshop with all potential participants in the refrigerator incentive scheme, in order to introduce the scheme. (PMO)

Activity 2.1.3: Provide general training in China on design modeling to all refrigerator manufacturers

All refrigerator design engineers will be provided with training in the use of computer modeling and design tools in efficient refrigerator design through an intensive 10-day refrigerator energy efficiency design modeling workshop conducted in China. See Annex 5b [PMO]

## 2.2 Output 2

Competitive refrigerator manufacturers selected for overseas training and participation in incentive program bid.

### Success Criteria

*Success in this output will be determined by the selection of 12 refrigerator manufacturers to participate in in-depth training abroad and in the incentive program bidding.*

Activity 2.2.1 Develop selection criteria and select qualified refrigerator manufacturers

Up to 12 competitive refrigerator manufacturers will be selected to participate in overseas intensive training and in the manufacturers incentive program. Criteria for qualification include: commitment to develop and market at least one refrigerator model achieving the "A" level of efficiency as defined in the current proposed refrigerator standard revision from the State Bureau of Technical Supervision; and a minimum production capacity of 200,000 refrigerators per year. [PMO]

Activity 2.2.2: Provide overseas intensive applied design training to chief designers in the qualifying refrigerator manufacturers:

The modeling training described in Activity 2.1.3 above will be followed by this six-month intensive training programs over two years for teams of refrigerator manufacturer design engineers at a leading international refrigerator design institute. During each 6-month period, 3 manufacturers selected in Activity 2.2.1 will send a team of 2 designers abroad along with a baseline refrigerator for redesign. The redesigned model will serve as the basis for the manufacturers' bid to receive the manufacturers incentive award as described in Activity 3.2. [Sub-contract 2]

Activity 2.2.3: Overseas training for engineering staff on technology options and selection

Qualifying refrigerator manufacturer engineering staff will participate in a 10 day design workshop abroad to introduce them to a full range of technology options, both commercially proven and leading-edge technologies, in the design and construction of energy-efficiency refrigerators, as currently in use internationally. Training will be supplemented with selected site visits. (PMO - see Annex 4b)

Activity 2.2.4 Support study tour for refrigerator manufacturer managers and planning officials

Twelve managers of refrigerator factories and planning officials will go on a 12-day study tour abroad to selected refrigerator companies and energy-efficiency centers. [PMO, see Annex 4c)

2.3. Output 3

Development and implementation of business and production plans for energy-efficient refrigerators and bid package for manufacturers incentive award in Activity 3.2

Success Criteria

*The success of this output will be indicated by the investment by refrigerator manufacturers in the production of energy-efficient refrigerators.*

Activity 2.3.1: Prepare business plans and bid package for incentive award.

Refrigerator manufacturers will receive technical assistance in the development of business plans for implementation of upgraded refrigerator designs and production technologies. International and domestic experts will assist manufacturers in developing these plans and documents, which will form the basis for the competitive bid to take place in conjunction with the Manufacturers Incentive Program described under Activity 3.2 [International refrigerator expert; Domestic refrigerator expert]

Activity 2.3.2: Provide on-site training for upgrading of energy-efficient manufacture

Refrigerator manufacturers will receive technical assistance from international and domestic experts (specific areas of expertise to be decided by the PMO based on factory input) in upgrading product design and technology, including assistance in evaluating and procuring equipment from international sources, where necessary. [International refrigerator expert; Domestic refrigerator expert]

Activity 2.3.3: Upgrade product designs and factory production technology

Manufacturers will implement new energy efficient product designs and, where necessary, upgrade or modify production technology and production equipment in order to manufacture those products. While the costs under this activity will be borne by participating factories

themselves, the incremental cost of this activity will be compensated for by incentive funds which the factories will receive on a competitive basis through the Manufacturers Incentive Program (see Activity 3.2 below). [Refrigerator Manufacturers]

### Immediate Objective 3

**Establish incentive framework to promote the design, production, consumer acceptance, and increased market sale of high-efficiency refrigerators**

#### 3.1 Output 1

Implementation of new minimum efficiency standards and increased capacity in the formulation of future standards.

#### Success Criteria

*Implementation of stricter maximum energy consumption standards for refrigerators and establishment of process for periodic revision of standards*

#### Activity 3.1.1 Hold Expert Workshop for Standards Review

Workshop attended by SBTS, SEPA, SALI, and manufacturers to review and finalize proposed energy-efficient refrigerator standards. [Supported under PA phase; to be completed by the third quarter of 1998]

#### Activity 3.1.2 Announce and disseminate new standards to manufacturers.

SBTS will meet with refrigerator manufacturers to announce and distribute proposed new efficiency standards, and announce plan of next round of standards revision. [Subcontract 3]

#### Activity 3.1.3 Establish committee to work on standards revision and hold workshop on next round of standards revision

SBTS will appoint a standards revision working committee and hold a workshop to discuss the next round of standards revision. [Subcontract 3]

#### Activity 3.1.4 Conduct industry survey and data collection

Industry survey and data collection and analysis in support of standards revisions. [Subcontract 3]

#### Activity 3.1.5 Develop proposed standard revision.

A draft of new minimum efficiency standards for refrigerators will be proposed to SBTS. [Subcontract 3]



Activity 3.1.6 Distribute draft standard to industry for comments.

SBTS will hold a meeting with manufacturers to explain the new standards and solicit comments from manufacturers during a 6-month period, on which final revisions to the proposed standard will be made. [Subcontract 3]

Activity 3.1.7 Announce, disseminate new standards to manufacturers and implementation of revised standards. [Subcontract 3]

3.2 Output 2

Financial incentives awarded to manufacturers to undertake the design and production of energy-efficient refrigerators.

Success Criteria

*Success of this output will be shown through i) the qualification and participation in bidding of manufacturers whose production account for the majority of the Chinese market, and ii) the award of incentive financing based on greatest energy savings gains in development of energy-efficient refrigerator models.*

Activity 3.2.1 Grant Basic Incentive Award .

Up to 12 qualified participants as determined in Activity 2.2.1 will receive a basic incentive award of US\$120,000. [PMO]

Activity 3.2.2. Organize and review bidding proposals for Principal Incentive Award.

The bidding proposals and business plans developed under 2.3.1 will be reviewed. The manufacturer achieving the highest energy savings will be identified. (see Annex 7 for further details). [PMO; Bid Review Committee]

Activity 3.2.3 Grant Principal Incentive Award

The principal award of US\$1,000,000 (minus the \$120,000 basic award) will be granted to the manufacturer achieving the greatest degree of energy savings as measured by efficiency gains over the baseline and volume of the model sold. [PMO]

Activity 3.2.4 Tracking energy-efficiency performance of bid-winners

Tracking of performance will be conducted over a three year period beginning after bids are awarded in combination with Activity 5.2.3. [This activity will be implemented through subcontract 4. the main goal of which is the establishment of the Public Information Center]

3.3 Output 3

Capacity developed to implement a mass-purchase program.

themselves, the incremental cost of this activity will be compensated for by incentive funds which the factories will receive on a competitive basis through the Manufacturers Incentive Program (see Activity 3.2 below). [Refrigerator Manufacturers]

### Immediate Objective 3

Establish incentive framework to promote the design, production, consumer acceptance, and increased market sale of high-efficiency refrigerators

#### 3.1 Output 1

Implementation of new minimum efficiency standards and increased capacity in the formulation of future standards.

#### Success Criteria

*Implementation of stricter maximum energy consumption standards for refrigerators and establishment of process for periodic revision of standards*

#### Activity 3.1.1 Hold Expert Workshop for Standards Review

Workshop attended by SBTS, SEPA, SALI, and manufacturers to review and finalize proposed energy-efficient refrigerator standards. [Supported under PA phase; to be completed by the third quarter of 1998]

#### Activity 3.1.2 Announce and disseminate new standards to manufacturers.

SBTS will meet with refrigerator manufacturers to announce and distribute proposed new efficiency standards, and announce plan of next round of standards revision. [Subcontract 3]

#### Activity 3.1.3 Establish committee to work on standards revision and hold workshop on next round of standards revision

SBTS will appoint a standards revision working committee and hold a workshop to discuss the next round of standards revision. [Subcontract 3]

#### Activity 3.1.4 Conduct industry survey and data collection

Industry survey and data collection and analysis in support of standards revisions. [Subcontract 3]

#### Activity 3.1.5 Develop proposed standard revision.

A draft of new minimum efficiency standards for refrigerators will be proposed to SBTS. [Subcontract 3]

Activity 3.1.6 Distribute draft standard to industry for comments.

SBTS will hold a meeting with manufacturers to explain the new standards and solicit comments from manufacturers during a 6-month period, on which final revisions to the proposed standard will be made. [Subcontract 3]

Activity 3.1.7 Announce, disseminate new standards to manufacturers and implementation of revised standards. [Subcontract 3]

3.2 Output 2

Financial incentives awarded to manufacturers to undertake the design and production of energy-efficient refrigerators.

Success Criteria

*Success of this output will be shown through i) the qualification and participation in bidding of manufacturers whose production account for the majority of the Chinese market, and ii) the award of incentive financing based on greatest energy savings gains in development of energy-efficient refrigerator models.*

Activity 3.2.1 Grant Basic Incentive Award.

Up to 12 qualified participants as determined in Activity 2.2.1 will receive a basic incentive award of US\$120,000. [PMO]

Activity 3.2.2. Organize and review bidding proposals for Principal Incentive Award.

The bidding proposals and business plans developed under 2.3.1 will be reviewed. The manufacture achieving the highest energy savings will be identified. (see Annex 7 for further details). [PMO; Bid Review Committee]

Activity 3.2.3 Grant Principal Incentive Award

The principal award of US\$1,000,000 (minus the \$120,000 basic award) will be granted to the manufacturer achieving the greatest degree of energy savings as measured by efficiency gains over the baseline and volume of the model sold. [PMO]

Activity 3.2.4 Tracking energy-efficiency performance of bid-winners

Tracking of performance will be conducted over a three year period beginning after bids are awarded in combination with Activity 5.2.3. [This activity will be implemented through subcontract 4, the main goal of which is the establishment of the Public Information Center]

3.3 Output 3

Capacity developed to implement a mass-purchase program.

### Success Criteria

*Success of this output will be shown through i) development of a mass-purchase program structure; and ii) the identification of potential mass purchasers of refrigerators*

#### Activity 3.3.1. Develop a Structure of the program

Structure the terms and process for a mass purchasing program. [PMO; Subcontract 5]

#### Activity 3.3.2 Identify mass-purchase targets

Identification of targets for the program, including, among others, residential apartment owners and developers, government agencies and housing offices, military housing providers, hotels, other large real estate owners and managers, and other volume purchasers or possible volume purchasers identified in conjunction with manufacturers. [PMO; Subcontract 5]

Activity 3.3.3 Develop specifications and procedures for mass purchase of refrigerators  
[PMO; Subcontract 5]

### 3.4 Output 4

Implementation of the dealer incentive program The activities below will be implemented in conjunction with the activities described under Activities 4.2.2 (in-store promotional materials development) and 4.3.2 (retail staff training).

### Success Criteria

*Success of this output will be shown through i) the training of retail staff at key marketing units and ii) award of financial incentives to retail staff who achieve the greatest increase in sales of energy-efficient models over base year quantities.*

#### Activity 3.4.1 Identify target cities and target sales units to carry out the programme.

Identification of target cities and target sales units based upon volume of refrigerators sold, identifying the 50 largest sales units in which the pilot program and national programs will be held. [FECO/PMO]

#### Activity 3.4.2 Design dealer incentive program.

Design the dealer incentive program and confirm the participants in both the pilot program and national program. Hold workshop to introduce the programme to the participants. [FECO/PMO]. See Annex 7 for further details.

#### Activity 3.4.3 Carry out Pilot Program

Launch the pilot program in 5 sales units [FECO/PMO]

Activity 3.4.4 Evaluate results of pilot program and revise the incentive programme.

After completion of the pilot program, results will be evaluated, and the program will be revised as needed before launching of the national program. [FECO/PMO]

Activity 3.4.5 Deliver pilot program awards

Awards to winning sales staff in the pilot program will be announced and awarded. [FECO/PMO]

Activity 3.4.6 Launch National program .

Launch of the dealer incentive program in the remaining 45 identified sales units. [FECO/PMO].

Activity 3.4.7 Grant awards to winning dealers among the 45 sales units and evaluate final results. [FECO/PMO]

3.5 Output 5

A business plan developed for the establishment of a pilot consumer buyback/recycling program (parallel financing, not GEF/UNDP financing)

Success Criteria

*Success of this output will be shown through the identification of location and partnerships, and development of a business plan for a recycling pilot program*

Activity 3.5.1 Identify pilot city

Identification of a pilot city to develop and evaluate recycling business plan. [Parallel financing]

Activity 3.5.2 Develop business plan

Evaluation of various options to create a financially viable recycling program that will be self-sustaining, and development of a business plan. [Parallel financing]

Immediate Objective 4

**Create market conditions of increased consumer demands for energy efficient refrigerators through consumer education, and increase capacity of sales force to promote energy-efficient refrigerator sales**

4.1 Output 1

A nationally certified energy-efficiency labeling programme developed.

Success Criteria

*Success of this output will be indicated by the development and implementation of a nationally certified energy-efficiency labeling programme for refrigerators*

Activity 4.1.1 Develop label concept and criteria

Concept and criteria for the energy-efficient label will be developed. This label will indicate to buyers that the product labeled is recognized nationally as energy-efficient, among other characteristics that may be incorporated into the label criteria (such as low-noise, CFC-free, etc.) [Subcontract 6]

Activity 4.1.2 Implement national labeling programme for refrigerators [subcontract 6]

4.2. Output 2

A broad range of public educational, market, and promotional campaigns on energy efficiency to increase demand for energy-efficient refrigerators.

Success Criteria

*Success of this output will be indicated by i) a significant increase in consumer awareness of the benefits of energy-efficient refrigerators as measured in periodic surveys; ii) the availability in key department stores and other major refrigerator sales channels of informational and promotional materials on energy-efficient refrigerators.*

Activity 4.2.1 Develop and disseminate through broadcast and print media material informing consumers of the benefits of energy efficiency

A public education program will be designed and implemented to introduce consumers to the benefits of energy efficient refrigerators. This campaign will include national television advertising and local newspaper advertisements. The campaign will be designed to complement advertising of individual energy efficient products undertaken by participating refrigerator manufacturers, but will promote the general benefits of energy efficiency, rather than particular products or refrigerator brands. The campaign will take place during the year leading up to the introduction of new energy-efficient refrigerator models to be promoted during the period of the manufacturers incentive program as described under Output 3.2. Further details of the consumer education program can be found in Annex 2. [Subcontract 7/Public Education Campaign Development; Subcontract 8/Media Planning and Purchasing, International Media Expert]

Activity 4.2.2 Develop and disseminate in-store points-of-sale materials allowing consumers to understand the features, benefits, and savings of energy-efficient refrigerators:

Consumer education materials will be developed and placed at point-of-sale locations, where the final purchase decision is made, so as to further build understanding and awareness of the

benefits of energy efficient products. The dissemination of this material will coincide with the dealers incentive program as described under Output 3.4 and the consumer education program in Activity 4.2.1 to maximize the impact of the material on consumer purchasing choices. [Subcontract 9]

Activity 4.2.3 Undertake public relations campaign to spread the core message of the benefits of energy-efficient refrigerators

General public education consisting of commissioned magazine and newspaper articles, news conferences, documentaries, and editorials will supplement consumer education. The activity will consist of, on average, development and placement of two newspaper articles per month and one magazine article per month, a news conference and a documentary. The PMO will identify Chinese or international experts to be commissioned to prepare the articles and editorials. [PMO; Subcontract 9]

4.3. Output 3

Increased capacity in retail channels to understand and promote the sale of energy-efficient refrigerators.

Success Criteria

*This output will be successful when the sales staff in at least the top 50 retail outlets in China are trained and are ready to participate in the dealer incentive program as described in Output 3.4.*

Activity 4.3.1. Develop training materials

Training materials focusing on the benefits of energy efficiency and techniques to promote retail sale of energy efficient products will be developed. [Subcontract 10]

Activity 4.3.2 Train trainers

5 Trainers will be identified and trained for one week with the materials developed in Activity 4.3.1. [Subcontract 10]

Activity 4.3.3. Provide training to retail staff in communicating the benefits of energy-efficient refrigerators

Trainers trained in Activity 4.3.2 will travel to sales units identified in Activity 3.4.1 (dealers incentive program), beginning with the sales units of the pilot program, then to remaining units for the national program. In-store training of staff will take approximately 2 hours each. [Subcontract 10]

## Immediate Objective 5

Establish national capacity to promote and manage energy efficiency in the refrigeration sector

### 5.1 Output 1

Framework of monitoring and evaluation of project progress and sector development established.

#### Success Criteria

*Success of this output will be established through the i) establishment of an information center; ii) determination of project metrics and iii) collection of baseline conditions*

Activity 5.1.1 Hold Inception workshop and draft inception report (PMO/Int. consultant)

Activity 5.1.2. Establish information center and project web site for long-term monitoring of project impacts

A Project Information Center (PIC) will be established in which the baseline survey information and annual survey results will be gathered and analyzed. The information center will be equipped with networked computers running appropriate database and other software. The PIC will develop a web site in order to provide broader dissemination of project activities and survey results. [Subcontract 4; Equipment; Hardware consultant; Software Consultant]

Activity 5.1.3. Develop metrics and format for information collection and analysis

A Working Group of experts will meet to propose and develop the baseline indicators for the project as well as the market response indicators to be collected as the project progresses. The working group will also propose the format for data collection, the methodology for analysis and presentation of the data, and content for public dissemination of information on the web site. [International Advisor, Domestic Advisor, International Refrigerator Expert, National Refrigerator Expert, National Compressor Expert; PMO]

Activity 5.1.4. Collect baseline sector data

The Project Management Office will commission a survey of existing refrigerator and compressor manufacturers, including production and sales by model and efficiency level, and of consumer buying attitudes, to gather the necessary information to establish the sector conditions in year 1 of the project, from which future progress will be measured. [Subcontract 4]

### 5.2 Output 2.

Monitoring and evaluation of project progress and sector development conducted



### Success Criteria

*Development of an annually updated database of refrigerator and compressor sector developments, including efficiency testing results, and of consumer attitudes towards energy efficient refrigerators.*

#### Activity 5.2.1. Collect manufacturer and market information

The PIC will collect production and market data on a half-yearly basis, and annually will provide a comprehensive report on manufacturing and market conditions to the Tripartite Review Board, to be held every 12 months, as supplement to the Project Performance Evaluation Report. A final report will be submitted at the end of the project period. [PIC]

#### Activity 5.2.2 Conduct annual survey of consumer attitude towards energy-efficient refrigerators

Public education results will be tracked, measured, and confirmed. Tracking and measurement activities will also include annual central location testing of 100-400 individuals per market to determine the ongoing effectiveness of consumer education work. The results of these surveys will be combined with the results of surveys conducted under Activity 5.2.1 and provided to the Tripartite Review Board. [Subcontract 11]

#### Activity 5.2.3 Test performance of upgraded refrigerators

Independent testing of the efficiency of the refrigerators manufactured by producers who have benefited from support under this project. At least 100 models will be tested, and the overall product line of the manufacturers monitored over the five years. [Subcontract 12]

## **E Inputs**

### **1.a National Inputs - Enterprises**

The bulk of total project costs (principally, design work on energy efficient models, retooling to produce energy efficient models, and the cost of marketing energy efficient models) will be met by participating Chinese refrigerator and compressor manufacturers. Manufacturers will commit to make these funds available for design, production, and marketing of energy efficient products from their own resources (or through loans or grants which they obtain) in order to participate in the project. The following table determines the estimated inputs from the enterprises in line with the project activities.

No.	Activity	Input
1.2.1	Planning Meeting	\$5,000
1.2.2	TA Business Plans, Proposals	4,500
1.3.2	TA Design and Production	45,000

No.	Activity	Input
1.3.3	Technology Design & Development	1,500,000
2.3.1	TA Business Plans, Proposals	15,000
2.3.2	TA Design and Production Plans	150,000
2.3.3	Conversion of Production Lines	24,000,000
4.2.1	Consumer Education/Advertising	4,000,000
	<b>Total</b>	<b>\$29,719,500</b>

### 1.b National Inputs - Government

SEPA and SALI have committed the Government of China (GOC) contribution in the form of in-kind support from their own budgets. These inputs include project personnel, facilities, DSA assistance for on-site visits and transportation.

#### Project personnel:

The personnel input will include salaries, allowance, personnel welfare expenditures and medical insurance. The total input in this regard will be:  $\text{RMB}50,550 \text{ person/year} \times 5 \text{ year} \times 8 \text{ persons} = \text{RMB}2,022,000$

#### Equipment and facilities:

This input includes administrative support for project-related staff, such as rent for office and meeting rooms, water, electricity, sanitary management charges, and various kinds of depreciation charges of office equipment. The total input in this regard is estimated to be:  $\text{RMB}200,850 \text{ person/year} \times 5 \text{ years} \times 8 \text{ persons} = \text{RMB}8,034,000$

#### On-site mission support:

This input includes the government support of DSA assistance for project related staff. The total input will be:  $\text{RMB}11,500 \text{ person/year} \times 5 \text{ years} \times 8 \text{ persons} = \text{RMB}460,000$

#### Transportation:

This input includes the cross-cities and local transportation costs: the total input will be:  $\text{RMB} 21,000 \times 5 \text{ years} \times 8 \text{ persons} = \text{RMB}840,000$

The total government input is therefore estimated at:  $\text{RMB}11,356,000$ , approximately  $\text{\$}1,370,000$

## 2. UNDP/GEF Inputs

A. International Consultants:

Six international consultants will be recruited by the project as follows:

- (1) International Compressor Expert (2 w/m)
- (2) International Design Modeling Expert (2 w/m)
- (3) International Labeling Expert (0.5 w/m)
- (4) International Refrigerator Expert (9 w/m)
- (5) International Project Advisor and Training Expert (18 w/m)
- (6) International Marketing Expert (1.5 w/m)
- (7) External Evaluation Expert (1 w/m)

TOR for these positions are provided in Annex 3. Payment for international consultants will include the consultant's fees, international travel costs, intra-China travel costs, accommodations, per diem, etc. The total budget for international consultants is US\$ 611,000.

B. National Consultants:

National consultants will be recruited by the project as follows:

- (1) Administration Assistant (to PMO) (60 w/m)
- (2) Bookkeeper/Accounting (to PMO) (12 w/m)
- (3) National Program Adviser (60 w/m)
- (4) National Compressor Expert (18 w/m)
- (5) National Refrigerator Expert (24 w/m)
- (6) National Monitoring and Evaluation Expert (10 w/m)

TOR for these positions are provided in Annex 3. Payment for national consultants will include fees, DSA and in-country travel costs. The total estimated cost for national consultants is \$344,000.

C. Duty Travel:

This component will cover the costs for project monitoring and evaluation by staff of UNDP and the Executing Agency. The total budget for duty travel is \$50,000.

D. Subcontracts:

A total of 12 subcontracts will be tendered, as follows:

- (1) In Country Compressor Training
- (2) International Intensive Refrigerator Design Training,
- (3) Standard Revision
- (4) Project Information Centre (5 years)
- (5) Mass Purchase Program
- (6) Labeling program
- (7) Public Educational Campaign Development
- (8) Media Planning and Purchasing

- (9) Public Relations and In-Store Information Development
- (10) Retail Education
- (11) Consumer tracking study
- (12) National Testing

Outline TOR for these are provided in Annex 2. The total budget for subcontracts is \$3,991,700.

#### E. Training:

The project will support in-country training, seminars and workshops. These include:

- (1) International Refrigerator Seminar and Exhibition (See Annex 5a)
- (2) Refrigerator Design Modeling Training workshop (see annex 5b)
- (3) Inception Workshop (\$10,000)
- (4) 3 Participant Workshops (@\$10,000 each)

The project will support the following overseas training:

- (1) Study tour of compressor staff (See Annex 4a)
- (2) Overseas training on refrigerator options for refrigerator manufacturer engineering staff (See Annex 4b)
- (3) Study tour of refrigerator manufacturer managers and planning officials on refrigerator options and selections. (See Annex 4c)

The total budget for training is \$554,500.

#### F. Equipment

The project will provide necessary equipment to establish the Project Information Center. Equipment includes a networked group of 8 computers, with Internet access. In addition, office equipment will be provided to the PMO to support the overall management of the project. (\$36,800) (See Annex 6)

The project is also to run 3 incentive programmes. These are described in detail in Annex 7. The costs for incentive programme are budgeted as follows:

- (1) Compressor manufacture incentive programme: \$500,000.
- (2) Refrigerator manufacture incentive programme: \$2,500,000
- (3) Dealer Incentive programme: \$365,000.
- (4) Communication: \$20,000

The total budget under equipment component is \$3,421,800.

#### G. Miscellaneous

Administrative and other costs will be incurred in the conduct of this project. These include: communication costs, Internet access, postage, preparation of reports and published project outputs, and sundry. The estimated cost is \$60,000.

Estimated costs for project support service is \$584,000. This includes \$234,000 for the UNDP CO and \$350,000 for the UN Cooperating Agency.

Total budget under miscellaneous component is \$664,000.

**Total GEF/UNDP Input: \$9,617,000**

## **F Risks**

There are five principal risks to achieving sustainability of project results:

1. High-efficiency refrigerator models may not be purchased once the market barriers targeted by this project are reduced, owing to other barriers that were not identified or not considered significant. For example, the project does not completely eliminate the higher first costs generally associated with high-efficiency models, given the determination that it would be cost-prohibitive to eliminate that discrepancy through a consumer rebate or other such price subsidy program (see discussion and recommendation that such a program not be pursued under the supplemental materials annex of the GEF brief, Annex 4.5 ). However, the project does address this issue by reducing the first cost discrepancy (through provision of training and technical assistance to manufacturers, which will reduce their product development costs and lead to price reductions relative to the baseline scenario given the competitiveness of China's refrigerator market), by increasing consumer willingness to pay through consumer education, and by providing a targeted incentive for purchasers to trade in their old refrigerators and purchase a new energy efficient one. Hence, the risk that the remaining price discrepancy will bar market penetration of energy efficient models is not considered high.

2. The increased market penetration of energy efficient models attributable to enhanced performance standards would be compromised by difficulty in enforcing those standards. However, given the increasing concentration of the sector (with 12 domestic manufacturers controlling 88% of sales in 1996), the small number of major manufacturers simplifies enforcement. Furthermore, planned consultations with manufacturers during the standard development and implementation process reduces the risk that manufacturers will either resist or be unaware of the standards. This risk is therefore considered small.

3. The risk that enterprises would be unable to fund the development and implementation of new energy efficient measures would greatly reduce the extent to which the project could achieve its goals, since enterprises are being asked to fund the non-incremental cost portion of the project. However, this risk is considered low, since commitments of adequate resources to the program will be a precondition to participation in the project. The risk that an insufficient

number of enterprises will be willing to make such commitments is considered low, given that the major manufacturers have been consulted in the development of this project and have expressed interest in participation and willingness to commit the necessary resources. Furthermore, refrigerator manufacturers are aware of the impact that new refrigerator performance standards and the proposed consumer education and dealer incentive programs will have on demand for more energy efficient refrigerators, and are therefore keenly interested in receiving the technical assistance which the project will provide so that they are able to produce such refrigerators.

4. There is a risk that the availability of higher efficiency models will influence the average size of purchased refrigerators and decisions to keep old or existing refrigerators in service, relative to the baseline scenario, and that emissions reductions would therefore be reduced by increased size of purchased refrigerators and retention of old refrigerators. However, this risk is believed to be negligible, since research in other countries and market research completed in China under the PDF demonstrate that the trend in China toward purchase of larger refrigerators and retention of older models are existing independent trends, and are unrelated to new refrigerator energy efficiency.

5. There is a risk that gains achieved as a result of this project will be short-term, i.e., that they would apply to one generation of models only, after which manufacturers would revert to production of non-efficient models due to unwillingness or inability to design and produce efficient ones. However, the project has been designed in order to minimize or eliminate this risk through a combination of demand and supply side measures, and project organizers believe that the activities outlined in this document at the level of effort proposed will be successful in doing so.

On the demand side, implementation of an energy efficiency label, retail staff training and incentives, and consumer education will provide a sustained impetus for refrigerator buyers to purchase energy efficient models.

On the supply side, first, new energy efficiency standards as well as the process of continually upgrading those standards to be inaugurated by the project will provide an ongoing impetus to refrigerator and compressor manufacturers to improve product energy efficiency in the future.

Second, the manufacturer incentive program has been designed to offset manufacturers' incremental up-front costs in developing new energy efficient models, and having done so will thus continue to have an effect after the program's conclusion (as opposed to a rebate program, which provides no ongoing incentive after its conclusion).

Finally, the program has been designed to create indigenous capacity for refrigerator manufacturers in China to continually upgrade refrigerator energy efficiency by training Chinese engineers in energy efficiency design principles, as opposed to importing proprietary foreign technology. As is often the case in developing countries, transfer of foreign technology without development of national capacity and skills can hinder rather than foster sustainable development.

Furthermore, to import single-product, single-supplier energy efficiency technology in this manner would compromise the open, non-proprietary nature of the technology, and would significantly increase costs. By focusing on training Chinese engineers instead of merely importing incrementally more efficient product designs, the project will create the institutional and human resource base necessary for further development and refinement of energy efficient products, and will ensure that the technology developed will be appropriate to the Chinese situation and available for dissemination to other manufacturers on a non-proprietary basis.

## **G Prior obligations and Pre-requisitions**

Prior to receipt of funding support or participation in other project activities, participating refrigerator manufacturers must commit to contribute the necessary in-kind resources to the project in order to insure its success. These resources include commitment of necessary design and management staff to participate in training program, attendance at all mandatory project events, and the commitment to implement energy efficiency measures as described in Section D (describing Immediate Objectives and Project Activities) above.

The State Environmental Protection Agency (SEPA) and State Administration for Light Industry (SALI) have fulfilled all other necessary prior obligations and pre-requisites, including budgetary allocations for the Chinese government contribution in cash and in kind.

## **H Project Reviews, Reporting and Evaluation**

The project will be subject to tripartite review (joint review by representatives of the Government, executing agency and UNDP) at least once every 12 months. The first such meeting will be held within 12 months of the start of full implementation. The executing agency will prepare and submit to each tripartite review meeting a Project Performance Evaluation Report (PPER). Additional PPERs may be requested, if necessary, during the project.

In addition to normal UNDP project monitoring and evaluation activities, long-term impact assessment will be initiated during the course of the project and provisions will be made to continue this assessment activity after the project is completed. Indicators will be developed, a baseline will be established for the indicators, and the indicators will be tracked over time relative to the baseline. Examples of "market response" indicators include market share by class of energy-efficient refrigerator, the number of dealers or distributors who are stocking and selling high-efficiency models, and household retention rates. More directly, the project will attempt to monitor reductions in market barriers, such as: (a) availability of energy-efficient compressors produced domestically; (b) understanding of consumers of the benefits of high-efficiency refrigerators; (c) anticipation by manufacturers that markets for high-efficiency refrigerators will expand in the future; (d) plans by manufacturers to produce high-efficiency models; (e) refrigerators sold carrying nationally certified and easy-to-

understanding labeling as to annual operating costs; and (f) dealer incentives to stock and sell high-efficiency models. An "Information Center" will be established in order to facilitate the collection and analysis of the market response indicators.

## **I Legal Context**

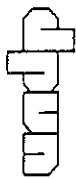
This Project Document shall be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement between the Government of the People's Republic of China and the United Nations Development Programme, signed by the parties on 29 June 1979. The host country implementing agency shall, for the purpose of the Standard Basic Assistance Agreement, refer to the government co-operating agency described in that Agreement.

The following types of revisions may be made to this Project Document with the signature of the UNDP resident representative only, provided he or she is assured that the other signatories of the Project Document have no objections to the proposed changes:

1. Revision in, or addition of, any of the annexes of the Project Document;
2. Revisions which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of the inputs already agreed to or by cost increases due to inflation; and
3. Mandatory annual revisions which rephrase the delivery of agreed project inputs or increased expert of other costs due to inflation or take into account agency expenditure flexibility.

## **J Budget**

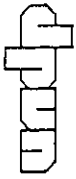




United Nations Development Programme  
 CPR/98/G31 - BARRIER REMOVAL FOR THE WIDESPREAD COMMERCIALIZATION OF ENERGY-EFFICIENT CFC-FREE  
 Budget "A"

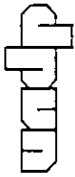
Main Source of Funds: 1G - Global Environment Trust Fund  
 Executing Agency: NEX - National Execution

SBLN	Description	Implementing Agency	Total	1999	2000	2001	2002	2003
011.01	Int'l Compressor expert	UNDDSMS	30,000	5,250	7,500	7,500	7,500	2,250
		% AOS		8.00	8.00	8.00	8.00	8.00
		AOS	2,400	420	600	600	600	180
011.02	Int'l design modeling expert	UNDDSMS	30,000	5,250	7,500	7,500	7,500	2,250
		% AOS		8.00	8.00	8.00	8.00	8.00
		AOS	2,400	420	600	600	600	180
011.03	Int'l labeling/standard expert	UNDDSMS	30,000	5,250	7,500	7,500	7,500	2,250
		% AOS		8.00	8.00	8.00	8.00	8.00
		AOS	2,400	420	600	600	600	180
011.04	Int'l refrigeration expert	UNDDSMS	135,000	23,625	33,750	33,750	33,750	10,125
		% AOS		8.00	8.00	8.00	8.00	8.00
		AOS	10,800	1,890	2,700	2,700	2,700	810
011.05	Int'l prog Advisor/tran expert	UNDDSMS	216,000	37,800	54,000	54,000	54,000	16,200
		% AOS		8.00	8.00	8.00	8.00	8.00
		AOS	17,280	3,024	4,320	4,320	4,320	1,296
011.06	Int'l Marketing Expert	UNDDSMS	20,250	3,542	5,063	5,063	5,063	1,519
		% AOS		8.00	8.00	8.00	8.00	8.00
		AOS	1,620	283	405	405	405	122
011.07	External Evaluation	UNDDSMS	20,000					20,000
		% AOS						8.00
		AOS	1,600					1,600
<b>011.99</b>	<b>Line Total</b>		<b>481,250</b>	<b>80,717</b>	<b>115,313</b>	<b>115,313</b>	<b>115,313</b>	<b>54,594</b>
		AOS	38,500	6,457	9,225	9,225	9,225	4,368
015.01	Duty Travel	NEX	50,000	8,750	12,500	12,500	12,500	3,750
<b>015.99</b>	<b>Line Total</b>		<b>50,000</b>	<b>8,750</b>	<b>12,500</b>	<b>12,500</b>	<b>12,500</b>	<b>3,750</b>
016.01	Messant Costs of 6 int'l experts	UNDDSMS	129,750	22,705	32,438	32,438	32,438	9,731
		% AOS		8.00	8.00	8.00	8.00	8.00
		AOS	10,379	1,816	2,595	2,595	2,595	778
<b>016.99</b>	<b>Line Total</b>		<b>129,750</b>	<b>22,705</b>	<b>32,438</b>	<b>32,438</b>	<b>32,438</b>	<b>9,731</b>
		AOS	10,379	1,816	2,595	2,595	2,595	778
017.01	Administrative assistant	NEX	60,000	10,500	15,000	15,000	15,000	4,500
017.02	Bookkeeper/Accountant	NEX	18,000	3,150	4,500	4,500	4,500	1,350
017.03	National Programme Advisor	NEX	120,000	21,000	30,000	30,000	30,000	9,000
017.04	National Compressor Expert	NEX	54,000	9,450	13,500	13,500	13,500	4,050
017.05	National Refrigeration Expert	NEX	72,000	12,600	18,000	18,000	18,000	5,400



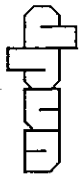
Main Source of Funds: 1G - Global Environment Trust Fund  
 Executing Agency: NEX - National Execution

SBLN	Description	Implementing Agency	Total	1999	2000	2001	2002	2003
017.06	Plant Monitoring and Eva Expt	NEX	20,000	1,000	4,000	4,000	4,000	4,000
<b>017.99</b>	<b>Line Total</b>		344,000	60,700	85,000	65,000	85,000	28,300
<b>019.</b>			1,005,000	172,872	245,251	245,251	245,251	96,375
			48,879	8,273	11,820	11,820	11,820	5,146
021.01	In Country Compressor Training	UNDDSMS	81,000	14,175	20,250	20,250	20,250	6,075
				8,000	8,000	8,000	8,000	8,000
			6,480	1,134	1,620	1,620	1,620	486
021.02	Intensive refry design training	UNDDSMS	477,600	83,580	119,400	119,400	119,400	35,820
				8,000	8,000	8,000	8,000	8,000
			38,208	6,686	9,552	9,552	9,552	2,866
021.03	Standards revision	NEX	80,000	17,500	15,000	15,000	25,000	7,500
021.04	Information Center	NEX	120,000	26,250	27,500	27,500	37,500	11,250
021.05	Mass Purchase Programme	NEX	50,000	8,750	12,500	12,500	12,500	3,750
021.06	Labeling Programme	NEX	100,000	17,500	25,000	25,000	25,000	7,500
021.07	Public education campaign	to be determined	435,500	76,212	108,875	108,875	108,875	32,663
021.08	Media Planning/Purchase Program	to be determined	2,226,500	389,637	556,625	556,625	556,625	166,988
021.09	Public Relations	NEX	180,700	31,622	45,175	45,175	45,175	13,553
021.10	Retail Education	NEX	118,100	20,667	29,525	29,525	29,525	8,858
021.11	Tracking Consumer Awareness	UNDDSMS	72,300	12,652	18,075	18,075	18,075	5,423
				8,000	8,000	8,000	8,000	8,000
			5,784	1,012	1,446	1,446	1,446	434
021.12	National Tasting Development	NEX	50,000	10,500	10,000	10,000	15,000	4,500
<b>021.99</b>	<b>Line Total</b>		3,991,700	709,045	987,925	987,925	1,002,925	303,880
			50,472	8,832	12,618	12,618	12,618	3,786
<b>029.</b>			3,991,700	709,045	987,925	987,925	1,002,925	303,880
			50,472	8,832	12,618	12,618	12,618	3,786
031.01	Oversea training on Refrig Options	NEX	165,700	28,997	41,425	41,425	41,425	12,428
<b>031.99</b>	<b>Line Total</b>		165,700	28,997	41,425	41,425	41,425	12,428
032.01	Study tour of compressor staff	NEX	110,000	19,250	27,500	27,500	27,500	8,250
032.02	Study tour of Refrig Man & Plan	NEX	100,000	17,500	25,000	25,000	25,000	7,500
<b>032.99</b>	<b>Line Total</b>		210,000	36,750	52,500	52,500	52,500	15,750



Main Source of Funds: 1G - Global Environment Trust Fund  
 Executing Agency: NEX - National Execution

SBLN	Description	Implementing Agency	Total	1999	2000	2001	2002	2003
033.01	In Country Seminar and exhibition	NEX	100,000	17,500	25,000	25,000	25,000	7,500
033.02	In Country on design modeling	NEX	37,300	6,615	9,450	9,450	9,450	2,835
033.03	Participant's workshops	NEX	30,000	5,250	7,500	7,500	7,500	2,250
033.04	Inception Workshop	NEX	11,000	1,925	2,750	2,750	2,750	825
<b>033.99</b>	<b>Line Total</b>		<b>178,800</b>	<b>31,290</b>	<b>44,700</b>	<b>44,700</b>	<b>44,700</b>	<b>13,410</b>
<b>039.</b>			<b>554,500</b>	<b>97,037</b>	<b>138,625</b>	<b>138,625</b>	<b>138,625</b>	<b>41,588</b>
045.01	Equipment	NEX	36,800	6,440	9,200	9,200	9,200	2,760
045.02	Compressor manu. incentive program	NEX	500,000	87,500	125,000	125,000	125,000	37,500
045.03	Manu. incentive program	NEX	2,500,000	437,500	625,000	625,000	625,000	187,500
045.04	Dealers incentive Program	NEX	365,000	63,875	91,250	91,250	91,250	27,375
045.72	Communication	NEX	20,000	3,500	5,000	5,000	5,000	1,500
<b>045.99</b>	<b>Line Total</b>		<b>3,421,800</b>	<b>598,815</b>	<b>855,450</b>	<b>855,450</b>	<b>855,450</b>	<b>256,635</b>
<b>049.</b>			<b>3,421,800</b>	<b>598,815</b>	<b>855,450</b>	<b>855,450</b>	<b>855,450</b>	<b>256,635</b>
052.01	Reporting	NEX	55,000	9,625	13,750	13,750	13,750	4,125
<b>052.99</b>	<b>Line Total</b>		<b>55,000</b>	<b>9,625</b>	<b>13,750</b>	<b>13,750</b>	<b>13,750</b>	<b>4,125</b>
053.01	Sundry	NEX	5,000	875	1,250	1,250	1,250	375
<b>053.99</b>	<b>Line Total</b>		<b>5,000</b>	<b>875</b>	<b>1,250</b>	<b>1,250</b>	<b>1,250</b>	<b>375</b>
054.01	Project Support Services	UNDDSMS	234,000	40,950	58,500	58,500	58,500	17,550
054.02	Agency Support Costs	UNDDSMS	250,649	10,000	80,000	80,000	42,000	38,649
<b>054.99</b>	<b>Line Total</b>		<b>484,649</b>	<b>50,950</b>	<b>138,500</b>	<b>138,500</b>	<b>100,500</b>	<b>56,199</b>
<b>059.</b>			<b>544,649</b>	<b>61,450</b>	<b>153,500</b>	<b>153,500</b>	<b>115,500</b>	<b>60,699</b>
<b>099.</b>	<b>BUDGET TOTAL</b>		<b>9,517,649</b>	<b>1,639,219</b>	<b>2,380,751</b>	<b>2,380,751</b>	<b>2,357,751</b>	<b>759,177</b>
	AOS		99,351	17,105	24,438	24,438	24,438	8,932
	Total		9,617,000	1,656,324	2,405,189	2,405,189	2,382,189	768,109

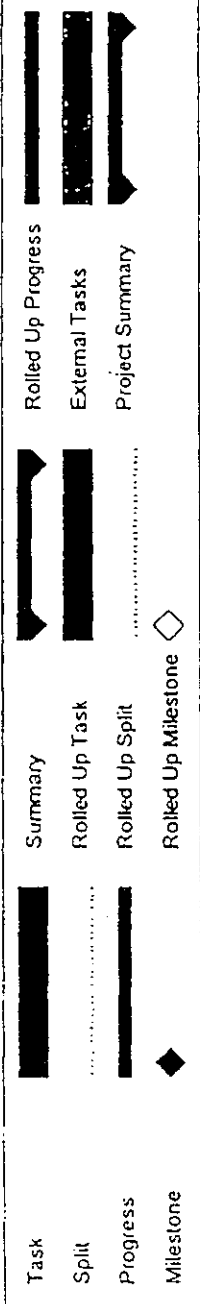
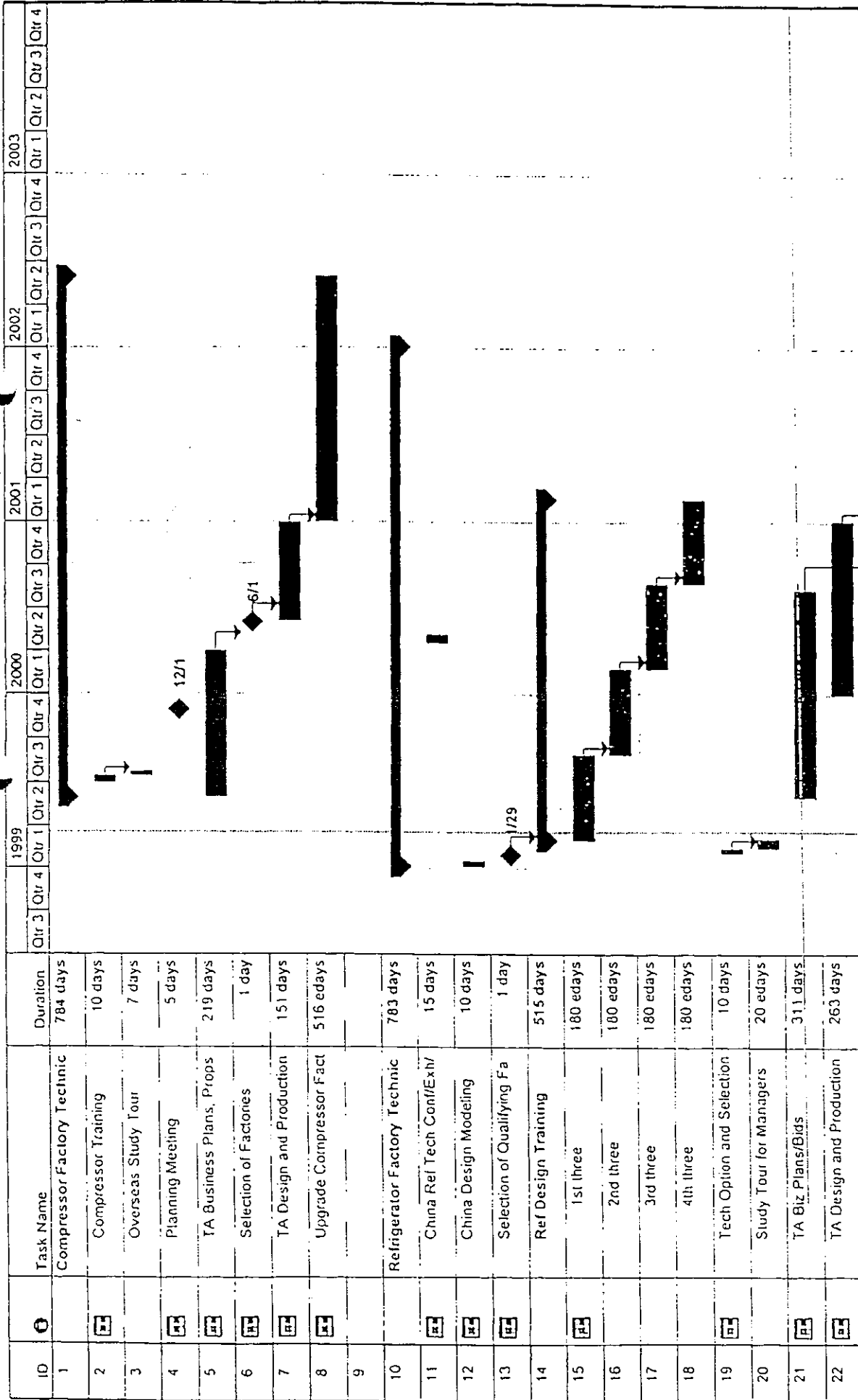


Main Source of Funds: 1G - Global Environment Trust Fund  
 Executing Agency: NEX - National Execution

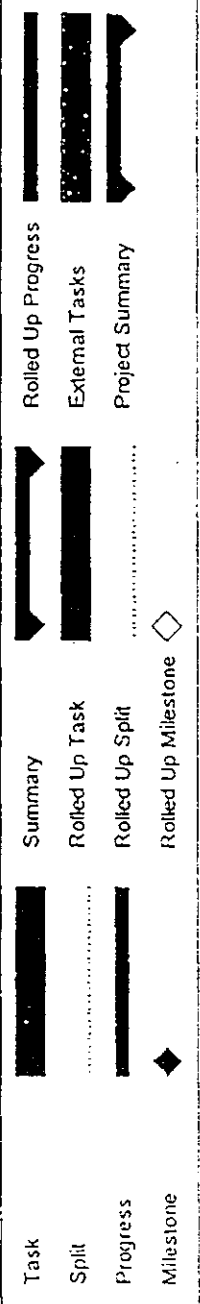
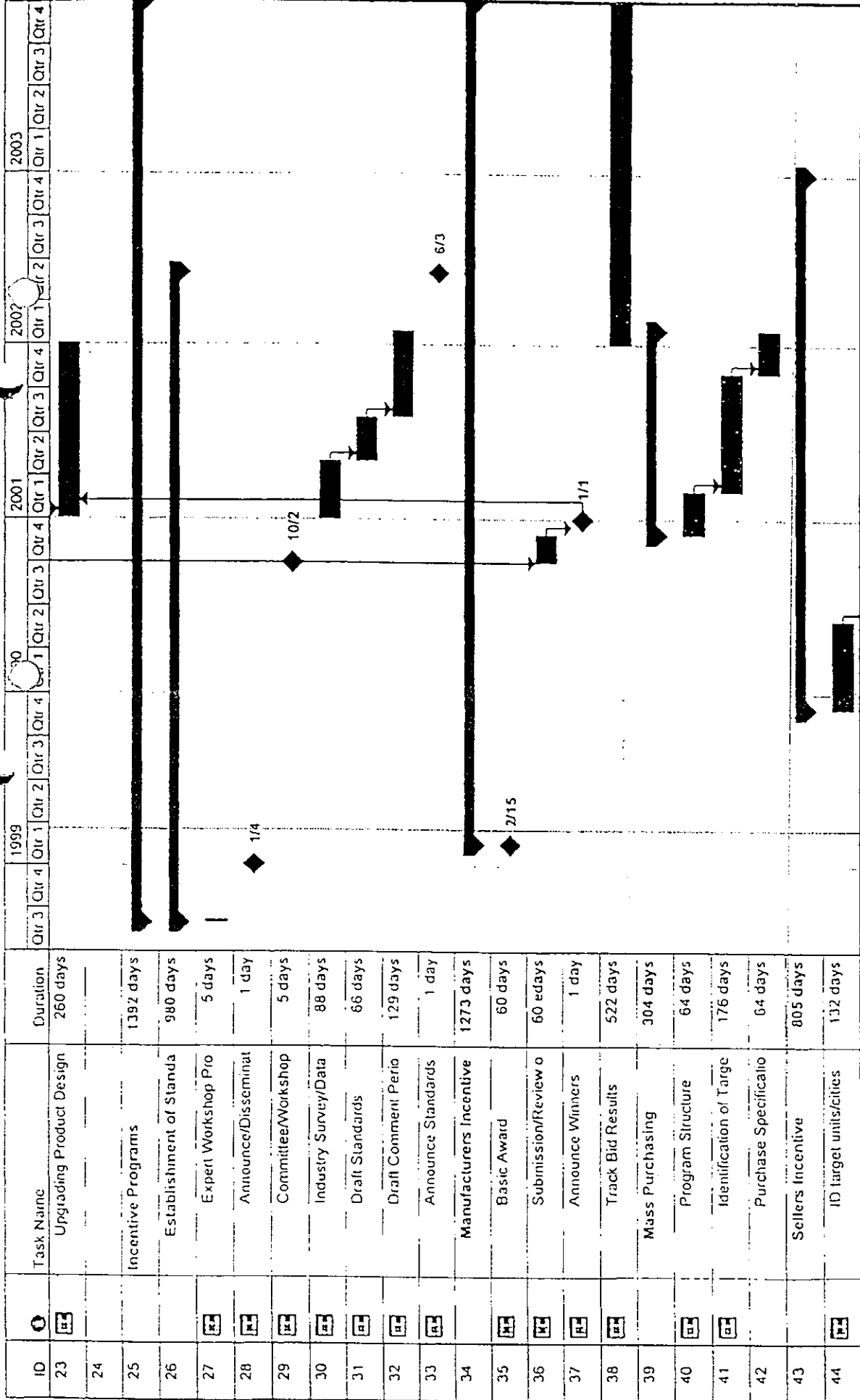
SBLN	Donor	Funding Institution	Total	1999	2000	2001	2002	2003
999.	NET CONTRIBUTION							
		Net Contrib.	9,517,649	1,639,219	2,380,751	2,380,751	2,357,751	759,177
		Total	9,617,000	1,656,324	2,405,189	2,405,189	2,382,189	768,109

Annex 1:	Workplan
Annex 2:	TOR for Subcontracts
Annex 3:	TOR for Consultants
Annex 4:	Overseas Training
Annex 5:	In-country Training
Annex 6:	Equipment
Annex 7:	Description of Incentive Programs
Annex 8:	Schematic Project Strategy
Attachment 1:	Capacity Building for National Execution
Attachment 2:	Incremental Cost/Benefit Table
Attachment 3:	Project Planning Matrix

## Annex 1: Workplan



Project: PRODOC2  
Date: Wed 3/17/99



Project: PRODOC2  
Date: Wed 3/17/99





ID	Task Name	Duration	1999				2000				2001				2002				2003			
			Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4		
67	Monitoring and Evaluation	1389 days	[Gantt bars spanning from Qtr 3 1999 to Qtr 4 2003]																			
68	Establish Information Cent	88 days	[Gantt bar in Qtr 1 1999]																			
69	Develop Meincs/Indicators	110 days	[Gantt bar in Qtr 1 1999]																			
70	Collect Baseline Data	153 days	[Gantt bar in Qtr 1 1999]																			
71	Ann'l Sector Data Collec	845 days	[Gantt bar from Qtr 1 1999 to Qtr 4 2003]																			
72	Annual Information C	60 days	[Gantt bar in Qtr 1 2000]																			
73	Annual Information C	60 days	[Gantt bar in Qtr 1 2000]																			
74	Annual Information C	60 days	[Gantt bar in Qtr 1 2000]																			
75	Annual Information C	60 days	[Gantt bar in Qtr 1 2000]																			
76	Annual Consumer Surve	847 days	[Gantt bar from Qtr 1 1999 to Qtr 4 2003]																			
77	Survey 1	65 days	[Gantt bar in Qtr 1 2000]																			
78	Survey 2	65 days	[Gantt bar in Qtr 1 2000]																			
79	Survey 3	65 days	[Gantt bar in Qtr 1 2000]																			
80	Survey 4	65 days	[Gantt bar in Qtr 1 2000]																			
81	Refrigerator Testing	365 edays	[Gantt bar from Qtr 1 2000 to Qtr 4 2000]																			

Project: PRODOC2  
Date: Wed 3/17/99

Task		Summary		Rolled Up Progress	
Split		Rolled Up Task		External Tasks	
Progress		Rolled Up Split		Project Summary	
Milestone		Rolled Up Milestone			

## **Annex 2: Outline TOR for Subcontracts**

This annex contains the outlines of the TOR for the sub-contracts. These TOR will be further developed during the project by the PMO.

## Terms of Reference: In Country Compressor Training Program Subcontract 1

### Description:

The compressor is the heart of the refrigeration cycle. Improvements in compressor efficiency will directly result in energy savings in the operation of refrigerators and freezers.

Domestic Chinese compressor technology is, in general, old and substantial improvements can be made through the introduction of state-of-the-art technology. Conditions typical to Chinese operating conditions, however, must be taken into account in this process.

A training programme will be run in China for design experts from a full range of Chinese compressor manufacturers. The training will be primarily for the experts from the compressor manufactures selected in activity 1.1.1, and for the experts who are later to go on the international tour (see annex 4a). However, a total of 32 experts will be invited all in all.

### Qualifications:

- Must have experience in organizing and implementing international workshops, preferably in China, including workshops with non-English speaking participants and including translation/interpretation.
- Must be familiar with international compressor manufacturers and research institutes

### Activities:

- Organize 10-day workshop in China, including all logistical preparations for meeting rooms, AV equipment, translation/interpretation facilities
- Work with PMO to confirm all workshop participants
- Arrange translation of workshop materials into Chinese
- Work closely with the international compressor expert

### Contents:

The focus of the training program will be application of energy efficiency measures to existing compressor designs; although theoretical principles will be reviewed, the content of the program will be highly applied. It is assumed the participants will be experienced in design and operational principles. Areas of design application to be covered include:

- A: Introduction
  - 1. brief review of the refrigeration cycle
  - 2. function of the compressor
  - 3. definition of compressor efficiency
- B. Review of Mathematical Principles
  - 1. gas flow analysis
  - 2. heat transfer
- C. Basic Review of Thermodynamics
  - 1. first law of thermodynamics

2. second law of thermodynamics
- D. Refrigeration Charts and Diagrams
  1. Mollier diagrams
  2. pressure-volume diagrams
  3. temperature-entropy diagrams
  4. pressure-enthalpy diagrams
- E. Compressor Types - brief review
  1. reciprocating (used in most refrigerators)
  2. rotary
  3. scroll
  4. centrifugal
  5. screw
  6. linear (special case of reciprocating)
- F. Refrigeration Cycles and Refrigeration Methods
  1. air
  2. ideal Carnot
  3. vapor compression (detailed study to follow)
  4. Stirling
  5. thermoacoustic (acoustic pulse tube)
  6. endothermic chemical cycle
  7. Peltier
- G. Vapor Compression Cycle (used in most refrigerators)
- H. Variations of the Vapor Compression Cycle
  1. dual cycles
  2. Lorentz cycle
  3. La Breque cycle
- I. Absorption Cycle
- J. The Reciprocating Compressor
  1. general description
  2. power losses
  3. motor
  4. bearings
  5. friction and windage
  6. compression losses
  7. compressor balance
    - a. static
    - b. dynamic
- K. The Compression Process
  1. isentropic compression
  2. isothermal compression
  3. polytropic compression
  4. actual compression
  5. gas re-expansion and hysteresis losses
- L. Motor Losses
  1. bearing losses (detailed analysis follows)

2. gas re-expansion and clearances
    - a. top of piston
    - b. discharge port
  3. others
    - a. suction gas heating
- M. Bearing Types and Descriptions
1. oil film thickness calculations
  2. fluid friction calculations
- N. Electronics and Controls
1. Single speed
  2. Two speed
  3. Variable speed
  4. AC versus DC
- O. Compressor Efficiency
1. testing methodology
  2. equipment and instrumentation
- P. Compressor Noise Control

**Output:**

- Translation of training workshop materials
- Organization of 10 day training workshop for 32 Chinese participants

**Estimated budget:**

Workshop personnel and experts, interpreters				\$30,000
Workshop material translation	700	Pages	\$20	\$14,000
Workshop meeting room rental	10	Days	\$400	\$4,000
Workshop AV equipment	10	Days	\$120	\$1,200
Workshop supplies & materials				\$2,000
Communication costs				\$1,000
Travel w/i China	30	People	\$200	\$6,000
Per diem in China (14 days)	420	Person-days	\$50	\$21,000
Total				\$81,000

**Location:**

The contractor will work from his/her home base to organize the China workshop and recruit, as appropriate, international experts.

**Deliverables and Due Dates:**

- Report on conference logistics, one month before workshop
- Translated training materials, due 2 weeks before workshop
- Final workshop report

## Terms of Reference: Intensive Refrigerator Design Training Subcontract 2

### Description:

The process of designing an energy efficient refrigerator, building prototype units with existing cabinets and conducting extensive tests and optimization of the cabinet for energy efficiency and overall system performance requires extensive training to be done correctly. An extensive training program in this area would lead to the creation of a core set of refrigerator design professionals with the ability to perform the required tasks to support transformation of the Chinese industry to the production of highly efficient models.

The training program would begin with a task definition that will occur before the actual visit to the training location of program participants, and could focus on improving the energy efficiency of a particular refrigerator or freezer of a given manufacturer. Based on this outline, a suitable cabinet will be shipped to the training location and baseline tested. After analysis of the results, modifications will be discussed, evaluated with the aid of theoretical models, and the best possible version implemented in hardware. The performance of the new system will then be measured and based on the measured data and extensive comparisons with the theoretical models, further optimized. The goal of this procedure is to obtain maximum energy efficiency for limited cost increases.

In the process, the participants become familiar with

1. modeling techniques and existing software,
2. comparison of measured data with model results and their interpretation,
3. operation of data acquisition systems,
4. measurement techniques, error margins and sources, and
5. procedures required to optimize refrigeration systems for a given objective.

With the newly gained experience, managers can judge more productively the effort involved in certain assignments and the time duration involved, while engineers learn about laboratory procedures, efficient optimization methods and gain confidence in applying them. In turn, they can teach other company personnel these techniques upon their return to China. Last but not least, the proposed training module establishes a firm background on which to develop company specific research and development procedures.

This training will take place at a leading international refrigerator design and research institute over a 2-year period. During each 6-month period, 3 manufacturers selected for participation in the project will send a team of 2 designers along with the baseline refrigerator for redesign. The redesigned model will serve as the basis for the manufacturer's bid to receive the manufacturer's incentive award.

### Qualifications:

- The selected location must be internationally recognized as a refrigerator design or research center
- The selected location must have facilities to allow 3 teams to work separately on refrigerator redesign in order to protect any proprietary company information
- The selected location must have complete testing and research facilities.
- The selected location must provide non-proprietary access to alternative refrigerator energy efficiency designs
- The instructor/staff must have experience in development and application of energy efficiency measures in refrigerators
- The selected location must be able to arrange local housing for Chinese participants
- Experience in working in the Chinese refrigerator sector and with Chinese refrigerator engineers is strongly preferred.

### Activities:

- Task 1: Project definition, selection of refrigerator or freezer model to be worked on and definition of the goals to be accomplished, to be conducted by the company in conjunction with the staff at the training institution before participants depart for the training program.
- Task 2: Baseline testing of original unit (1 month).
- Task 3: Modeling of existing unit and of improved version, finalizing of design of new unit and building components as necessary (1 months in parallel to Task 2).
- Task 4: Modification of unit (1 month).
- Task 5: Testing of new unit, comparison with theoretical model results and optimization by adjusting charge, capillary tube and improving new and old components as needed (3 months).
- Task 6: Final evaluation, and confirmation with theoretical models, writing of report and definition of follow-on work (1 month).

The tasks will be repeated 4 times, each time with 3 sets of 2 designers.

### Output:

1. training materials
2. tested energy-efficient refrigerator and freezer designs
3. final reports and work plans for additional work
4. 24 highly trained refrigerator/freezer design professionals



Estimated budget:

Trainee int'l air fare	24	round trip	\$2,000	\$48,000
Trainee housing (2/apt)	24	person-months	\$600	\$14,400
Trainee living expenses (6 months)	4,380	person- days	\$40	\$175,200
International training staff	4	person years		\$150,000
Facilities, communications, & supplies				\$90,000
Total				\$477,600

Location:

International Refrigeration Design/Research Institute

**Terms of Reference: Standards Revision  
Subcontract 3**

**Description:**

Implementation of new minimum efficiency standards for refrigerators and increased capacity in the formulation of future revisions.

**Qualifications:**

- Must be thoroughly familiar with China's draft minimum standard for refrigerators.
- Must understand and can apply methodologies to analysis of standard revision impact on manufacturers and on total energy consumption
- Must have good working relationship with SBTS
- Should have good knowledge of standards and their application internationally.

**Activities:**

- Announce and disseminate new standards to manufacturers. Meet with refrigerator manufacturers to announce and distribute proposed new efficiency standards, and announce next round of standards revision.
- Establish standards revision working committee and workshop on next round of standards revision. Appoint a standards revision working committee and hold a workshop to discuss the next round of standards revision, in Q4 2000.
- Collect data on refrigerator industry technology and economics, and undertake industry survey.
- Analyze data and survey results, and develop new proposed standard. Propose to SBTS a draft of new minimum efficiency standards for refrigerators.
- Disseminate draft standards to industry for comment, for a six-month period.
- Announce and disseminate new standard to manufacturers and implement revised standard.

**Output:**

- New national minimum efficiency standard for refrigerators (prepared as GB series document)

**Estimated budget:**

Industry survey data collection	\$40,000
Draft standard development	\$20,000
Expert review workshop	\$10,000
Implementation workshop	\$10,000
Total	\$80,000

**Location:**

Beijing, China

**Terms of Reference: Information Center Establishment and Operation,  
and Tracking of bid-winners  
Subcontract 4**

**Description:**

The information center will provide a central location for the collection and analysis of project-related information, including required data for monitoring purposes, and for annual updates of project results. It will also serve as the dissemination focus for project results, through print and web media.

**Qualifications:**

- The center should be located in a relevant Chinese agency or association concerned with Chinese appliance market
- The center should be staffed by personnel familiar with the Chinese appliance industry
- The center leadership should collaborate very closely with the project PMO
- Center staff should have experience in information collection, compilation, and dissemination

**Activities:**

- Establish information center and equip with networked computer, with Internet connection, and web site
- Develop metrics and format for information collection and analysis.
- Collect baseline sector data
- Undertake annual industry survey of refrigerator and compressor manufacturers
- Compile results of consumer survey and add to database
- Collect detailed data on winners of manufacturers incentive programme.

**Output:**

- Networked office with Internet connection
- Computer database containing industry and consumer data collection results and report generator
- Web page for dissemination of project results
- Annual reports on survey results

**Estimated budget:**

Establishment				30,000
Operation	5	years	\$18,000	\$90,000
Total				\$120,000

**Location:**

Beijing

**Deliverables and Due Dates:**

- Office to be established within six months of commencement of project
- Working Group proposal for metrics and format for data collection and analysis, within 4 months of establishment of office
- Baseline data collected and entered into computer database within 6 months of Working Group proposal
- Annual industry survey within 8 months of end of previous calendar year (4 times)
- Annual summary reports of information collection results, including industry survey and consumer survey (5 times)

## **Terms of Reference: Mass Purchase Program Subcontract 5**

### **Description:**

The purpose of a mass purchase program is to use the leverage provided by bundled purchases to (1) demonstrate to manufacturers that an adequate market exists for the target product, (2) work with manufacturers to determine the specifications for that product based on purchaser needs, and (3) use competition among manufacturers to focus manufacturer attention on energy efficiency and other desired product features, maximize cost-effective energy efficiency gains, and reduce product price. Similarly, commitment by the Chinese government and other potential mass purchasers to purchase only energy efficient CFC-free refrigerators that met program criteria would create a sizable guaranteed market for manufacturers of those products.

As mass-purchasing programs have not been developed in China, this activity aims at building capacity for the development of a refrigerator mass-purchase program for energy-efficient refrigerators.

### **Qualifications:**

- Must be familiar with China refrigerator distribution, wholesale and retail marketing channels
- Should be familiar with mass purchase programs in use internationally
- Should be familiar with economics of energy efficient refrigerators.
- Should be familiar with refrigerator energy efficient technology and specifications

### **Activities:**

- Structure the terms and process for a mass purchasing program through consultation on programs already in use internationally.
- Working with the PMO, identify targets for the program, including, among others, residential apartment owners and developers, government agencies and housing offices, military housing providers, hotels, other large real estate owners and managers, and other volume purchasers or possible volume purchasers identified in conjunction with manufacturers.
- Hold discussions with the potential targets for mass purchase and selected manufacturers to modify, if needed, the terms of the initial mass purchase program.
- Develop specifications and procedures for mass purchase of refrigerators.
- Develop and distribute information on energy efficient refrigerator to potential mass purchasers

### **Output:**

This subcontract will develop capacity in China to implement a mass purchasing program by creating a program plan, identifying and targeting possible mass purchasers of energy efficient refrigerators, and developing bid specifications for mass purchase. Information on energy efficient refrigerator will be developed and distributed to potential mass purchasers.

**Estimated budget:**

Program development				\$25,000
Program implementation	5	years	\$5,000	\$25,000
Total				\$50,000

**Location:**

China, primarily Beijing, and locations determined by identification of potential mass purchasers.

**Terms of Reference: Labeling Program  
Subcontract 6**

**Description:**

This subcontract covers activities designed to develop new energy-efficiency criteria for inclusion in a new or existing label to be applied to energy-efficient refrigerators.

**Qualifications:**

- Must be familiar with China's existing labeling programs
- Should be familiar with international labeling programs
- Must be familiar with refrigerator energy-efficiency issues and measurement standards

**Activities:**

- Task 1 Develop label concept
- Task 2 Review options for energy efficiency criteria
- Task 3 Propose energy-efficiency criteria to be incorporated in label
- Task 4 Prepare implementation plan for label
- Task 5 Promote label

**Output:**

A nationally certified label with energy efficiency criteria for refrigerators

**Estimated budget:**

Program design	\$20,000
Program implementation	\$80,000
Labeling program total	\$100,000

**Location:**

China

## Terms of Reference: Public Education Campaign (Subcontract 7)

### Description:

The subcontractor for this work will design a one year nationwide public education campaign to introduce consumers to the benefits of energy efficient refrigerators, including campaign design and development of creative content. The campaign will potentially include a range of media tools, including national television advertising, local television advertising, local newspaper advertising, magazine advertising, and other public education/advertising media. Proposed distribution and combinations of media use will be based on an evaluation of the benefits and cost effectiveness of these various advertising media, and will be based on the recommendations of the successful bidder for the subcontract to be issued under this Terms of Reference. Funding for this work is from the Global Environmental Facility (GEF) via the United Nations Development Programme (UNDP), which is acting as the Executing Agency for the project.

The campaign will promote the general benefits of energy efficiency rather than promote particular products or brands, although the subcontractor will be expected to coordinate with refrigerator manufacturers' own advertising campaigns in order to leverage the impact of advertising dollars spent. Cooperative advertising by manufacturers will take place,<sup>3</sup> and UNDP/GEF-funded advertising may include references to manufacturers that are participating in the project and that have developed energy efficient products (such references will, however, be inclusive of all participating manufacturers and their energy efficient products, rather than focusing on individual manufacturers). Although cooperative and other energy-efficiency-related advertising by manufacturers will continue beyond the one year duration of the UNDP/GEF-funded advertising campaign, the limited duration of the latter requires that the public education campaign be well designed and focused so as to achieve maximum impact with the advertising dollars available.

The campaign is expected to begin during the second quarter of the third year of project implementation, and will be timed so as to take place prior to and during the introduction of new energy-efficient models to be designed and commercialized by Chinese refrigerator manufacturers participating in the project. The campaign will also seek to inform consumers of the energy efficiency label to be developed through the project, and potentially also promote the energy efficiency benefits of consumer attention to new mandatory energy consumption labels now in development in China.<sup>4</sup>

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<sup>3</sup> In order to participate in this project, manufacturers are required to commit to allocating 10% of the value of their advertising investment to energy efficient products and/or the benefits of energy efficiency during this campaign and for the remainder of the five year project (for a total of approximately three years of cooperative advertising).

<sup>4</sup> Decisions on the approach that the consumer education program will take in promoting energy efficiency labels will be made by the project's leadership body after consultation with the successful bidder and other relevant national and international project consultants regarding possible strategies.



The campaign designed through this subcontract will be implemented under Subcontract 8, Media Planning and Purchasing, covering implementation of the campaign through placement of the creative content developed in accordance with the campaign.

Because of the inter-relationship among these areas, it is expected that the subcontractors executing the individual subcontracts will coordinate closely in their execution. It is also not excluded that one subcontractor would undertake all two of these subcontracts (and/or potentially also other marketing or market research related work), if that subcontractor demonstrates excellence in each of the applicable subcontract areas. In view of these inter-relationships, firms bidding on this subcontract should indicate their possible interest in other subcontracts, as well as any economies of scale or quality improvements that will result from a joint contract award (i.e. an award of more than one subcontract). If so doing would result in administrative efficiencies for the subcontractor and/or the Implementing Agency for the subcontracts, then the contracting parties could enter into a combined contract covering the multiple award areas.

#### **Qualifications:**

- Evaluation criteria include: number of staff based in China; individual and total number of years experience of professional staff based in China
- Must work nation-wide in scope and in multiple media
- Should have extensive advertising campaign development track record in China (evaluation criteria: years of experience in China, volume of current and past work (billings))
- Should have experience in work with both international and Chinese clients (evaluation criteria: number of billing volume of international and Chinese clients)
- Experience with and/or knowledge of the Chinese refrigerator industry beneficial

#### **Activities:**

- Develop public education campaign proposal
- Develop creative content for campaign
- Provide creative support during implementation of campaign
- Coordinate closely with media planner/purchasers and public relations activities

#### **Output:**

The output under this subcontract will be the campaign design, creative support, and creative content development for the public education campaign. The program's success will be indicated by increased consumer awareness of the benefits of energy efficient refrigerators, which will be measured via the periodic surveys that will take place under Subcontract 11, Tracking Studies. Specifically, the public education campaign will seek to:

- Gain broad acceptance of energy efficient refrigerator technology
- Motivate first-time and repeat refrigerator purchasers to purchase energy efficient refrigerators

- crators; and
- Encourage refrigerator owners without current plans to upgrade to purchase a new, energy-efficient refrigerator

**Estimated Budget:**

Campaign strategy	1	year campaign		\$151,807
TV creative content design	1	year campaign		\$115,663
Newspaper creative content design	1	year campaign		\$36,145
TV, Newspaper ad production	1	year campaign		\$120,482
In-store promotion material design	1	year campaign		\$1,807
In-store promotion material production	30,000	shelf talkers	\$0.12	\$3,600
In-store promotion material production	10,000	posters	\$0.60	\$6,000
Total				\$435,500

**Location:**

At least the bulk of the work of campaign strategy and creative content development is expected to take place in China. All creative support during execution of the campaign will take place in China.

**Deliverables and Due Dates:**

- Draft public education campaign strategy document
- Review meeting
- Revised public education campaign strategy
- Creative content for campaign implementation
- Monthly reports on campaign development

(Due dates should be added based on current project schedule at time of TOR issuance, based on an updated project timeline.)

(REFERENCE: add original detailed proposal for public education campaign developed under PDF to the Annex)

**Terms of Reference: Media Planning and Purchasing  
Subcontract 8**

**Description:**

The subcontractor for this work will implement a one year nationwide public education campaign to introduce consumers to the benefits of energy efficient refrigerators. The campaign will potentially include a range of media tools, including national television advertising, local television advertising, local newspaper advertising, magazine advertising, and other public education/advertising media. Proposed distribution and combinations of media use will be based on an evaluation of the benefits and cost effectiveness of these various advertising media, and will be based on the recommendations of the successful bidder for the subcontract to be issued under Subcontract 7.

The campaign is expected to begin during the second quarter of the third year of project implementation, and will be timed so as to take place prior to and during the introduction of new energy-efficient models to be designed and commercialized by Chinese refrigerator manufacturers participating in the project. The campaign will also seek to inform consumers of the energy efficiency label to be developed through the project, and potentially also promote the energy efficiency benefits of consumer attention to new mandatory energy consumption labels now in development in China.

The campaign to be implemented under this subcontract will be developed under Subcontract 7. Public Education Campaign, which covers creative development of the campaign materials. Because of the inter-relationship among these areas, it is expected that the subcontractors executing the individual subcontracts will coordinate closely in their execution. It is also not excluded that one subcontractor would undertake all two of these subcontracts (and/or potentially also other marketing or market research related work), if that subcontractor demonstrates excellence in each of the applicable subcontract areas. In view of these inter-relationships, firms bidding on this subcontract should indicate their possible interest in other subcontracts, as well as any economies of scale or quality improvements that will result from a joint contract award (i.e. an award of more than one subcontract). If so doing would result in administrative efficiencies for the subcontractor and/or the Implementing Agency for the subcontracts, then the contracting parties could enter into a combined contract covering the multiple award areas.

**Qualifications:**

- Must have experience in media purchasing and planning for a variety of media, including ideally as many media types as possible (e.g. national television, local television, newspapers, magazines, radio, outdoor). The bidder should indicate which of these areas in which the bidder possesses experience, and the degree of experience (evaluation criteria: years experience in area, number of staff working in area, value and number of placements in area)

- Must have strong execution ability (evaluation criteria: track record in placing advertising spots in premium spots with quick turnaround; ability to obtain discounts from published rates.) The ability to obtain discounts is key, given the limited advertising budget. The bidder should include a history and evaluation of discounts of list rates

obtained in the past.

- Should have budget/reach/frequency allocation modeling software and market prioritization model (key to media planning and execution)
- Should subscribe to industry rating reports.
- Must have the ability to track placement fulfillment through national and regional tracking services.
- Must have offices and permanent professional and support staff in China (evaluation criteria: number of staff based in China; individual and total number of years experience of professional staff based in China)
- Should have extensive advertising campaign implementation track record in China (evaluation criteria: years of experience in China, volume of current and past work (billings))
- Should have experience in work with both international and Chinese clients (evaluation criteria: number of billing volume of international and Chinese clients)

**Activities:**

- Create media purchasing plan based on target audience, media reach, and frequency allocation models
- Implement public education campaign through media purchase nationwide.
- Track media placement fulfillment
- Prepare a monthly report on media placement results

**Output:**

The output of this activity will be the execution of a nationwide media campaign promoting the benefits of energy efficiency and the benefits of energy-efficient refrigerators to Chinese consumers.

**Estimated Budget:**

TV advertising	156	spots	\$10,874	\$1,696,380
Newspaper advertising	52	weeks	\$10,195	\$530,120
Total				\$2,226,500

**Location:**

China

**Terms of Reference: Public Relations  
Subcontract 9**

**Description:**

This subcontract will consist of general public education including the commissioning of magazine and newspaper articles, news conferences, documentaries, and editorials to supplement consumer education through public media (television and newspaper advertisements). The PMO will identify Chinese or international experts to be commissioned to prepare the articles and editorials.

**Qualifications:**

- Criteria include: number of staff based in China; individual and total number of years experience of professional staff based in China)
- Must work nation-wide in scope and in multiple media
- Should have extensive public relations development track record in China
- Experience with and/or knowledge of the Chinese refrigerator industry beneficial

**Activities**

- Develop and place editorials on energy efficiency bi-weekly
- Develop and place magazine articles on energy efficiency monthly
- Develop and create a documentary film on energy efficiency
- Organize and implement new conferences
- Coordinate closely with development and implementation of Subcontract 7 and 8

**Output:**

The output of this subcontract will be newspaper editorials, magazine articles, a documentary film and news conference coverage focusing on the benefits of energy efficiency and promoting the purchase of energy efficient refrigerators.

**Estimated budget:**

Bi-weekly editorials (development & placement)	26	Article	\$2,500	\$65,000
Monthly magazine article (development & placement)	12	Article	\$5,000	\$60,000
Documentary	1	Film	\$30,700	\$30,700
News conference	1	Event	\$25,000	\$25,000
Total				\$180,700

Location:

China

## Terms of Reference: Retail Education

### Subcontract 10

#### Description:

To prepare retail staff for participation in the retailers incentive program, trainers will be organized, trained, and sent with materials to the top stores/cities in China to conduct training seminars.

#### Qualifications:

- Must be familiar with energy-efficiency issues and energy efficiency economics
- Must be familiar with China refrigerator retail channels
- Must be familiar with training materials targeted directly to retail staff
- Must be native or fluent Chinese speaker
- Must have expertise in organizing training activities and developing long-term training agendas

#### Activities:

Task 1: Develop training materials, including brochures for distribution in all stores, on the benefits of energy efficiency and sales techniques to promote energy efficient refrigerator sales.

Task 2: Organize and train 5 trainers for one week in the materials developed in the previous task

Task 3: Develop training agenda for the trainers, focusing first on stores participating in the retail incentive program pilot program, followed by remaining stores participating in national program. This should be done in coordination with the Public Relations Subcontractor, who will be developing in-store promotional materials.

Task 4: The 5 trainers will travel to the sales units identified in Task 3 to provide an approximate 2-hr training seminar in each store.

#### Output:

- Training materials
- Brochures on energy efficiency
- 5 trained trainers

Estimated budget:

Brochure design				\$9,667
Brochure production	10,000	copies	\$4.82	\$48,193
Trainers (5 people)	60	person-months	\$482	\$28,916
Trainer travel costs				\$31,325
Total				\$118,100

Location:

China



**Terms of Reference: Tracking of consumer awareness  
Subcontract 11**

**Description:**

Collect statistical information on Chinese consumer awareness of and opinions about energy efficiency and energy-efficient refrigerators and socioeconomic and other barriers that hinder the widespread adoption of energy-efficient refrigerator technology.

**Qualifications:**

- Must have ability and experience to draft questionnaires, implement consumer research surveys, compile survey results, analyze survey data, prepare analytical reports, and develop comprehensive marketing plans.
- Must have offices and permanent professional staff in China.
- Should have experience in working with international clients.
- Should have local staff.
- Should have extensive track record in China.

**Activities:**

- Work with PMO and project experts to develop survey questionnaire.
- Conduct market survey in 5 Chinese cities, including Beijing, Shanghai, and Guangzhou, and two other locations to be determined in conjunction with the PMO and project experts.
- Work with project experts to develop survey participant qualifications.
- For each location, qualify and survey a minimum of 250 participants.
- Perform a statistical analysis of survey results
- Prepare comprehensive analytical report and provide to Project Information Center

**Output:**

- Comprehensive report containing survey results and analysis.

**Estimated budget:**

Interviews (per city targeted)	400	people per market	\$12.05	\$4,819
National tracking program	5	cities	\$4,819	\$24,100
Total (three surveys over 5 year period)	3	surveys	\$24,100	\$72,300

**Location:**

The work will be undertaken in China in a total of 5 cities, including Beijing, Shanghai, Guangzhou, and two other locations to be decided.

**Terms of Reference: Chinese Testing Agency  
Subcontract 12**

**Description:**

The activities identified in this project are mainly either technical push activities or market pull activities, which are designed to remove barriers to the widespread commercialization of CFC-free energy efficient refrigerators. Incentive programs, public education programs, together with project supervision and management, are all major important components of market-creating activities and established on the foundation of testing results. Testing activities will be conducted several times during the project to ensure the fairness, transparency and the establishment of a fair competitive environment for manufactures to improve their energy efficient products.

**Qualifications:**

National testing certification

**Output**

Refrigerator energy consumption test results

**Estimated budget:**

\$50,000

**Location:**

China

**Deliverables and Due Dates:**

Testing will be conducted:

At the beginning of the project

Before the incentive awards,

Before the public education program,

Before the completion of the project

Annex 3: TOR for Consultants

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## Terms of Reference: International Compressor Expert

### Description:

International expert on the compressor industry and energy-efficiency measures in compressor design.

### Qualifications:

- In-depth knowledge of the international compressor industry required
- Experience in compressor design, production, or research required
- Engineering background preferred
- International work experience preferred, particularly in non-English speaking locations

### Activities:

- Provide technical assistance for preparation of business plans for upgrading designs and production technologies (1 month)
- Provide technical assistance to individual factories for upgrading designs and production technologies (1 month)

### Output:

- Compressor Factory Technical Assistance
- Training on high-efficiency designs and production technologies
- Technical assistance for preparation of business plans for upgrading designs and production technologies
- Provide technical assistance for upgrading designs and production technologies

**Estimated budget:** (this includes fees under BL11 and travel costs under BL16)  
2 m/m - \$36,000

### Location:

Consultants homebase, and international travel to China

### Deliverables and Due Dates:

- Training agenda and materials, one month before workshop
- Trip reports from 2 international missions

## **Terms of Reference: International Design Modeling Expert**

### **Description:**

Expert will train refrigerator design engineers in the use of computer modeling and design tools in efficient refrigerator design.

### **Qualifications:**

- Complete familiarity with ERA (EPA Refrigerator Analysis) or a similar software required
- Experience in refrigerator design, production, or research required
- International work experience, particularly in non-English speaking locations, preferred

### **Activities:**

- Expert will prepare training workshop agenda and materials
- Expert will organize and implement an intensive 10-day refrigerator energy efficiency design modeling workshop.
- Expert will coordinate with PMO to ensure selection of appropriate trainees.

### **Output:**

- Design engineers from refrigerator factories trained in the use and application of software.
- Training materials

### **Estimated budget:**

2 m/m \$36,000

### **Location:**

Consultant's home base and China (for training)

### **Deliverables and Due Dates:**

- Training materials and agenda, one month before workshop

## **Terms of Reference: International Labeling & Standard Expert**

### **Description:**

The international labeling expert will provide consulting services to the energy-efficiency-labeling program concerning options and issues of label development in other countries.

### **Qualifications:**

- The contractor must be familiar with international energy efficiency labeling programs and labeling programs specifically for refrigerators.
- The contractor must be familiar with the technical basis of refrigerator efficiency testing.
- The contractor must be familiar with the major international standards systems, including ISO and IEC.
- The contractor should be familiar with the national refrigerator standards of China.
- The contractor should have academic or professional experience in labeling program development.
- The contractor should have academic or professional experience in China.

### **Activities:**

- Work with the selected contractor in China under subcontract 6 to provide an overview of international labeling efforts, labeling options, impact of labeling programs, labeling criteria selection, and goals of labeling programs in countries outside China.
- Provide advice and comments, as requested, on China's proposed labeling scheme.
- Work with the selected contractor in China under subcontract 3, to provide overview of international standard setting efforts
- Provide necessary training on methodologies (ISO methodology in particular) and analytical tools for development of new energy efficiency standards

### **Output:**

- Reports

### **Estimated budget:**

2 two-week mission. \$30,000

### **Location:**

Contractors homebase and China (2 mission)

### **Deliverables and Due Dates:**

- Reference material on international labeling program and standard setting, to be provided at a time decided by Chinese contractor in subcontract 6 and subcontract 3.

## Terms of Reference: International Refrigeration Expert

### Description:

An expert in refrigerators, refrigeration technology, and the international refrigerator industry to provide training and consulting services to Chinese factories and the PMO.

### Qualifications:

- In-depth knowledge of the international refrigerator industry required
- Experience in refrigerator design, production, or research required
- Engineering background preferred
- International work experience preferred, particularly in non-English speaking locations

### Activities:

- Assist factories in the production of business plans and bid packages for the manufacturers incentive award (3 months)
- Provide technical assistance to individual factories for upgrading designs and production technologies (3 months)
- Participate in PMO Working Group to establish project data collection needs, indicators, and metrics
- Provide advisory input as requested during the contract period from the PMO.

### Output:

- Manufacturer bids for incentive awards
- Technical assistance in the preparation of upgrade designs for manufacturers
- International perspective in development of project indicators and metrics

### Estimated budget:

9 m/m \$162,000

### Location:

Expert's home base and China.

### Deliverables:

- Trip reports within 1 month of completion of missions



## Terms of Reference: International Program and Training Advisor

### Description:

The complexity of the project necessitates management support from a part-time International Program Advisor, during the project implementation phase to ensure timely completion and integration of results for the tripartite review. The International expert will work as a liaison and coordinator with Chinese counterparts and with other international expert contracted through the GEF in the task areas described above under the individual sections of this document.

The Programme advisor should also play a key role in the definition and implementation of the project training programmes.

### Qualifications:

- Have professional experience with project management.
- Have professional experience in working in China and with Chinese counterparts.
- Have the ability to speak, read, and write Chinese.
- Be familiar with household refrigeration and energy efficiency issues.
- Be familiar with international energy efficiency programs.
- Be familiar and able to work with international and national expert in relevant fields.
- Be familiar with safety, testing, and certification issues in the refrigerator sector.
- Be familiar with energy development in China, economic analysis, spreadsheet analysis and related social and technical issues in the appliance and energy sectors.
- Have good communications and writing skills.

### Activities:

- Play a key role in the inception workshop and draft the inception report
- Advise UNDP and Chinese project participants on substantive project issues.
- Advise the Project Management Office regarding establishment of systems for project management.
- Assist the PMO in the finalisation of all TOR for personnel and sub-contractors;
- Provide advice in development and monitoring of workplans and schedules.
- Provide advice in development of competitive bid materials.
- Review GEF outputs to ensure fulfillment of requested efforts.
- Perform GEF-related communication and liaison work.
- Review agendas, curricula, training materials, and training work plans (TORs) for international training activities.
- Provide assessment and comments to PMO for each activity
- Provide PMO with list of potential workshop participants, workshop locations, and international expert trainers.

- Provide advisory services to international subcontractors undertaking training activities

**Budget:** 18 m/m \$300,000

May be based either in China or elsewhere. If foreign based, the expert will be expected to travel periodically to China in support of GEF work.

**Deliverables and Due Dates:**

1. Trip report (within 4 weeks of completion of each project mission)
2. Copies of correspondence and communications with project participants.

## Terms of Reference: International Marketing Expert

### Description

The project is to design and implement an extensive multimedia campaign to promote energy efficient fridges, in conjunction with ongoing marketing activities by the manufacturers. This will include TV, newspaper and possibly media coverage.

This complex and expensive campaign is to be designed and purchased through sub-contracts, which will be submitted to the strictest international bidding processes.

In order to assist the Executing Agency and the PMO to design the bidding process, select the best bidder, and monitor implementation, an international expert on media/marketing will be recruited.

### Activities

- (1) Draft and finalise TOR for design sub-contract
- (2) Draft and finalise TOR for purchasing sub-contract
- (3) Identify potential sub-contractors
- (4) Plan the bidding process
- (5) Provide independent technical support to the bidding process
- (6) Prepare a plan for the monitoring of the implementation of the 2 subcontracts

### Qualifications

Full knowledge of international best marketing practices. Full knowledge of Chinese marketing system. Experience in the refrigerator or home appliance sector preferred.

### Budget

2 missions will be held. The first for four weeks to prepare TOR and prepare for the bid. The second for two weeks to support the finalisation of the bidding process. Total cost S27,000

## Terms of Reference: Administrative Assistant

### Description:

Work with the PMO staff, International and national program advisors in developing and implementing workplans and schedules and supporting the liason work between UNDP, Chinese project participants, and Chinese and international experts and subcontractors. .

### Qualifications:

- Candidate is adept in speaking, reading, and writing English. He/she should be able to comprehend relevant English technical and project management terms and convey their meaning to Chinese peers.
- Have university degree in management field or relevant technical field in refrigeration
- Candidate should have good communication and writing skills
- Working experience on international cooperation projects

### Activities:

- Provide secretariat support to PMO office in project implementation
- Support the PMO in preparing workplan, progress report, etc.
- Provide translation service during management meetings
- Perform project -related communication and liaison work.

### Estimated budget:

60 m/m \$60,000

### Location:

Beijing, China

## Terms of Reference: Bookkeeper/Accountant

### Description:

Work with PMO to in implementation of project activities, especially in financial reporting and book-keeping work.

### Qualifications:

- Candidate should have university degree in accounting
- Candidate is adept in speaking, reading, and writing English
- Working experience in international organization or international project management is an asset.

### Activities:

- Support the PMO in preparation of financial reports to UNDP and other relevant agencies
- Keeping financial records in project expenditures and carry out other relevant book-keeping task

### Estimated budget:

12 m/m. \$18,000

### Location:

Beijing, China

## Terms of Reference: National Program Advisor

### Description:

Work with the International program advisor in developing and implementing workplans and schedules, act as liaison between UNDP, Chinese project participants, and Chinese and international experts and subcontractors. Support PMO in implementation of project activities. The Program Advisor should have in-depth knowledge of and direct experience with China's refrigerator sector.

### Qualifications:

- Expert is adept in speaking, reading, and writing English; expert should be able to comprehend relevant English technical and project management terms and convey their meaning to Chinese peers.
- Expert should speak and read Chinese.
- Expert is familiar with household refrigeration and energy efficiency issues.
- Expert is familiar and able to work with international and national experts in relevant fields.
- Expert is familiar with safety, testing, and certification issues in the refrigerator sector
- Expert should have good communication and writing skills

### Activities:

- Coordinate GEF activities in conjunction with UNDP and Chinese project participants to ensure timely completion.
- Review GEF outputs to ensure fulfillment of requested efforts.
- Assist in development and implementation of the compressor, refrigerator, and retailer incentive programs.
- Perform GEF-related communication and liaison work.

### Estimated budget:

60 m/m. \$120,000

### Location:

The Program Advisor should be based in Beijing, China in order to ease coordination and communication with Chinese government project participants, UNDP Beijing, and visiting experts and subcontractors.

## Terms of Reference: Chinese Compressor Expert

### Description:

Development of a program and implementation plan to transfer technology to Chinese compressor manufacturers to allow for production of high-efficiency compressors.

### Qualifications:

- Needs to be fluent in native Chinese.
- Have a refrigeration engineering background
- Have experience in international experience on compressor technologies
- Have experience or familiarity with energy-efficiency programs in China or else-where.
- Have the ability to lead, manage, and participate in redesigning household refrigerators.
- Have good command of English (read, speak and write)

### Activities:

- Expert will oversee compressor design and testing at factories and testing institutes
- Expert will assist manufactures in upgrading compressor technologies in promoting energy-efficient refrigerator.
- Provide on-site training for compressor factories
- Be willing to conduct extensive travel.

### Output:

- Monthly progress report, listing in detail activities undertaken in the previous month and activities foreseen/recommended for the following month.
- Technical reports of factory and research institute lab results (in English), within three weeks of completion of visits.
- Provision of background information on Chinese compressor industry, as required by GEF, including
  - (a) production data (by factory, where available),
  - (b) technical and product information on target factory product design, refrigerant used and other relevant technical data, and
  - (c) background information on individual target manufacturers, including future development plans, research programs, marketing programs and after-sales-service programs.
- This information in appropriate format (reports, charts, tables, etc.) will be provided on an as-available and/or as-needed basis, in close coordination with the GEF.

**Estimated budget:**

18 m/m \$54,000

**Location:** Beijing and other sites to be determined



## Terms of Reference: Chinese Refrigeration Expert

### Description:

The work to be performed by the expert includes oversight of refrigerator design and testing at factories and testing institutes and promotion of energy-efficient, CFC-free designs to current and potential new project participants.

### Qualifications:

- Needs to be fluent in native Chinese.
- Have a refrigeration engineering background
- Have experience with alternative refrigeration systems (e.g. Lorenz cycle), and
- Have experience or familiarity with energy-efficiency programs in China or else-where.
- Have the ability to lead, manage, and participate in redesigning household refrigerators.

### Activities:

- Expert will oversee refrigerator design and testing at factories and testing institutes
- Expert will assist manufactures in upgrading energy-efficient refrigerator manufacture
- Per GEF direction, expert will oversee refrigerator redesign via meetings, presentations and technical cooperation with Chinese manufactures.
- Provide on-site training to refrigerator manufacturers
- Be willing to conduct extensive travel.

### Output:

- Monthly progress report, listing in detail activities undertaken in the previous month and activities foreseen/recommended for the following month.
- Technical reports of factory and research institute lab results (in English), within three weeks of completion of visits.
- Provision of background information on Chinese refrigerator industry, as required by GEF, including
  - (d) production data (by factory and refrigerator, where available),
  - (e) technical and product information on target factory product design, refrigerant used, foaming agent used, refrigerant cycle used, energy consumption, and other relevant technical data, and
  - (f) background information on individual target manufacturers, including future development plans, research programs, marketing programs and after-sales-service programs.

- This information in appropriate format (reports, charts, tables, etc.) will be provided on an as-available and/or as-needed basis, in close coordination with the GEF.

**Estimated budget:**

24 m/m, \$72,000

**Location:**

Beijing and other sites to be determined.

## Terms of Reference: National Monitoring and Evaluation Expert

### Description

The contractor will be hired to track impacts of project activities. The scope of monitoring will cover all the project activities. His or her findings should provide a good technical basis for monitoring and evaluation of project results/progress achieved.

### Qualification

- Expert is adept in speaking, reading, and writing English, expert should be able to comprehend relevant English technical reports ;
- Expert is familiar with household refrigeration and energy efficiency issues;
- Expert should have good experience in evaluating international cooperation projects. Previous working experience in UNDP project will be an asset .

### Activities:

- Monitor project implementation progress and evaluate project impact, in particular provide comments on technical aspects of project results to project authorities and the funding agency;
- Prepare and submit half-yearly monitoring and evaluation reports;
- Join the project management meetings and TPRs to report monitoring findings;
- Field monitoring missions to manufacturers who win the bids of the incentive programme and check the implementation status of the new efficiency technologies;
- Work with Subcontractor 4 (Information Centre) and Subcontractor 12 (National Testing) to track project impacts related to manufacturers production activities and consumer survey;
- Review technical reports produced by the consultants and provide comments to project management group;
- Provide support and work with the External Evaluator.

### Outputs:

- Half-yearly monitoring and evaluation reports;
- Mission reports from site visits;
- Written comments on technical reports produced by the project

### Estimated budget

\$20,000

### Location:

Beijing and project sites

## Annex 4: Overseas Training

#### 4a) TOR for Study Tour of Compressor Company Staff

##### Background:

In conjunction with the in-country training to be implemented under sub-contract 1, 16 staff will visit compressor manufacturers in Europe and North America to witness firsthand research activities and production lines of efficient compressors. The 16 members of the Tour will be from the manufacturers selected under activity 1.1.1 and the same people as those trained under sub-contract 1 (Activity 1.1.2)

The compressor is the heart of the refrigeration cycle. Improvements in compressor efficiency will directly result in energy savings in the operation of refrigerators and freezers.

Domestic Chinese compressor technology is, in general, old and substantial improvements can be made through the introduction of state-of-the-art technology. Conditions typical to Chinese operating conditions, however, must be taken into account in this process.

The itinerary will be developed by the PMO with assistance from the national and international compressor experts.

##### Outputs:

- A 10 day tour for 16 Chinese participants, one interpreter and the international compressor expert;
- A tour report;

##### Estimated budget:

International expert,				\$24,700
logistics interpreters and telecommunications				15,000
Air fare China - Europe	18	people	\$1,000	\$18,000
Travel w/i Europe	36	person-trips	\$200	\$7,200
Per diem - Europe (4 days)	72	person-days	\$150	\$10,800
Airfare Europe-US	18	people	\$1,000	\$18,000
Travel w/i US	36	person-trips	\$200	\$7,200
Per diem - US (3 days)	54	person-days	\$150	\$8,100
Total				\$110,000

#### 4b) Terms of Reference: Overseas Training on Refrigerator Options for Refrigerator Manufacturer Engineering Staff

##### Background

Many improvements can be made to existing refrigerator and freezer designs to improve their energy efficiency. Training is required to properly select appropriate technology and then to test the improvements, once they have been incorporated into a new refrigerator design.

Demonstrations of the application of many new energy efficiency technologies and proper testing procedures is critical to their most effective application in the Chinese refrigerator industry. Demonstration of the application of many new technologies can be done with the aid of a bread-board refrigerator model that allows individual components or combinations of components to be easily substituted into an existing refrigerator design. Additional technologies application can be seen by site visits of laboratories and factories after the training workshop.

This training is for refrigerator manufacturer engineering staff. The manufacturers targeted will have been selected under activity 2.2.1.

##### Activities:

Task 1: Develop workshop materials.

Task 2: Conduct 10 day workshop with the following proposed outline.

###### A. Overview

1. introduction
2. course materials and handouts
3. list of publications
4. lab tour

###### B. Test Procedures

1. closed-door test
2. heat-leak test
3. k-value test
4. instrumentation
5. software packages

###### C. Refrigerants and Properties

1. HFC 134a vs HC 600a
2. energy results

###### D. Foam Blowing Agents and Insulation

1. HCFC 141b
2. cyclopentane
3. vacuum panel insulation
4. next generation foams

###### E. Flammability Issues

###### F. Heat-Leak Tests

1. instrument and test refrigerator/freezer
2. foam improvements
- G. Calorimeter Tests
  1. instrument and test compressor
  2. compressor efficiency improvements
- H. ERA Model Training
  1. overview
  2. model inputs
  3. case studies
- I. Energy Consumption Tests
  1. instrument and test refrigerator/freezer
- J. Cycle Component Improvements
  1. heat exchangers
  2. fans and motors
  3. compressors
  4. cycles
- K. Cabinet Improvements
  1. gasket region
  2. foaming techniques
  3. thick doors
- L. Heat Exchanger Improvements
  1. evaporator
  2. condenser
- M. Manufacturing Concerns
  1. reliability
  2. safety
  3. cost
- N. Advanced Cycles
  1. Lorenz-Meutzner
  2. two-speed compressors
- O. Wrap-up

Task 3: Conduct site visits with the following possible preliminary list of stops:

Americold Compressor factory  
 Frigidaire refrigerator factory  
 University of Maryland  
 Technical University of Denmark  
 Zanussi refrigerator and compressor factories, Italy

Deliverables and Outcomes:

1. Training program curriculum, one month before workshop
2. Training workshop materials
3. 10 days training workshop
4. 10 days site visit



Estimated budget:

Training Workshop:

Workshop personnel, interpreters, organizers, and telecommunications				\$40,000
Workshop material translation	700	pages	\$20	\$14,000
Workshop meeting room rental	10	days	\$400	\$4,000
Workshop AV equipment	10	days	\$120	\$1,200
Workshop supplies & materials				\$1,000
Air-fare -China (int'l expert)	1	person	\$2,000	\$2,000
Travel w/i China	16	people	\$200	\$3,200
Per diem in China (10 days)	420	person-days	\$50	\$21,000
Sub-Total				\$86,400

Site Visits:

Organization			10,000	\$10,000
Air fare China - Europe	18	people	\$1,000	\$18,000
Travel w/i Europe	36	person-trips	\$200	\$7,200
Per diem - Europe (4 days)	72	person-days	\$150	\$10,800
Airfare Europe-US	18	people	\$1,000	\$18,000
Travel w/i US	36	person-trips	\$200	\$7,200
Per diem - US (3 days)	54	person-days	\$150	\$8,100
Sub -Total				\$79,300

Total: \$165,700

#### 4C) STUDY TOUR Terms of Reference: Refrigerator Policy Makers Tour

##### Description:

Highest level refrigerator manufacturer managers and selected policy-makers require broader, policy-level information to assist them in consideration of issues such as technology selection, production planning, standards development, and competitive assessment. This TOR describes the 10-day international study tour for selected refrigerator factory managers and policy-makers to relevant refrigerator manufacturers abroad as well as to selected energy-efficiency centers and policy-related organizations.

The itinerary of the tour will be developed by the PMO with the assistance of the international experts.

##### Estimated budget:

International Flights: China, North America, Europe	\$55,000
DSA: 12 days, 11 persons	\$24,000
Internal (Europe, N. America) flights 10 x 11 persons x \$200	\$22,000
Misc	\$1,000
Total	\$100,000

##### Location:

International: US and Europe

##### Deliverables and Due Dates:

- Itinerary 2 months before start of tour
- All necessary documents, translations, contact information, etc. 2 weeks before tour

## Annex 5: In-country Training

## 5a) Terms of Reference: International Refrigerator Seminar and Exhibition

### Description:

A wide variety of technologies exist for improving the energy efficiency of current refrigerator designs, and many new technologies are close to commercialization. Incorporating the available technologies into current refrigerator designs has the potential to reduce energy consumption by over 40 percent, while the new emerging technologies have the potential to further reduce energy consumption by an additional 30 percent. As many of the technology providers do not currently do business in China and others do not market their "best" technology in China, an exhibition should be held to showcase to the Chinese market the state-of-the-art of energy efficiency technologies for refrigerators and freezers. In conjunction with the exhibition, a seminar/workshop should be held to introduce the Chinese industry and policy makers to the potential for energy savings and the current state-of-the-art in this field.

Areas to be showcased in the seminar and exhibition include:

- compressors,
- refrigerants,
- expansion and control devices,
- insulation materials,
- fans and heat exchanger systems, and
- system optimization technology and testing devices.

Each of the seminar presentations will consist of a one to two hour lecture on one of the topics, followed by a two to three hour workshop on problems associated with implementation of the "best" technologies in China.

The seminar/workshop will last three days and be held during a four to five day long exhibition of the technologies. These events will be conjoined with a national or international appliance exhibition organized by SALI. The seminar presentations and exhibition materials will be compiled and published as a resource book on the current state-of-the-art of energy efficiency technologies for refrigerators and freezers.

### Activities:

- Task 1: Develop list of potential speakers and exhibitors.
- Task 2: Develop seminar and exhibition time table.
- Task 3: Invite speakers and exhibitors and follow up to ensure their acceptance of the invitations.
- Task 4: Organize 3 day seminar and 4 to 5 day exhibition.
- Task 5: Conduct seminar and exhibition.
- Task 6: Compile, edit and publish *Proceedings*.

### Deliverables and Outcomes:

1. list of potential seminar and exhibition participants
2. supporting materials for seminar and exhibition
3. 3 day seminar and 4 to 5 day exhibition
4. Proceedings

**Estimated budget:**

Air fare to China	14	people	\$2,000	\$28,000
Per diem (3 days) (experts)	42	person-days	\$150	\$6,300
Meeting room rental	3	days	\$400	\$1,200
Exhibit hall rental	6	days	\$4,000	\$24,000
AV equipment	3	days	\$120	\$360
Telecommunications				\$4,000
Experts and secretariat support				\$7,000
Supplies & materials				\$29,000
Total				\$100,000

**Location:**  
China

## 5b Terms of Reference: Design Modeling Training

### Description:

The EPA Refrigerator Analysis Program (ERA) provides an analysis tool for evaluation of conceptual design alternatives for household refrigerator/freezers. Capable of representation of typical designs used in the US, Asia and Europe, ERA is used on a world-wide basis. A significant portion of the experience in the development of ERA was based on refrigerator designs and laboratory testing in China.

Appropriate use of ERA, as with any design tool, requires a thorough understanding of its capabilities and limitations. The user must understand the implications of input data choices and must be in a position to knowledgeably assess the validity of the program output. An appreciation for the relationship of the model approach to real-world design issues is necessary for a correct application of the tool.

### Activities:

Task 1: Develop workshop materials.

Task 2: Conduct 10 day workshop with the following outline.

#### A. Overview Session (2 days)

##### 1. Overview of Workshop

- introduction
- objectives of the workshop
- checklist of attendees interests
- course materials and handouts
- lists of references

##### 2. Executive View of ERA Program

- purpose of program
- parameters addressed by ERA
- simplified view of overall calculation approach

##### 3. Program Installation and Structure

- installation disk
- program files
- overall data and program flow

##### 4. Overview of Sample Application

- definition of reference design
- navigation through program
- introduction to output files

##### 5. Hands-On Session

- group definition of changes to sample application
- practice session
- discussions

#### B. In-Depth Examination of ERA (2 days)

##### 6. Definition of Design Goals

- typical Chinese refrigerator design options
- comparison with typical American refrigerator designs
- options for efficiency improvements
- 7. Approach to Cabinet Loads Analysis
  - basic cabinet types
  - heat transfer mechanisms
  - alternate insulation methods
  - open vs closed door conditions
  - methods for temperature control
  - program calculation assist routines
- 8. Hands-On Cabinet Design Evaluation
  - define sample cases
  - define design constraints and technical options
  - demonstration of sample analysis
  - user practice session (design competition)
  - discussion of results
- 9. Review of Capabilities and Limitations for Cabinet Loads Analysis
  - what worked from Hands-On session
  - limiting factors in analysis
- 10. Approach to Cycle Analysis
  - basic cycles
  - refrigerant properties
  - heat transfer mechanisms
  - compressor model approaches
  - options for temperature control
  - program calculation assist options
- 11. Hands-On Cycle Design Evaluation
  - define design constraints and technical options
  - demonstration of sample analysis
  - user practice session (design competition)
  - discussion of results
- 12. Review of Capabilities and Limitations in Cycle Analysis
  - what worked from Hands-On Session
  - limiting factors in analysis
- C. Review of First Week of Workshop (3/4 day)
  - 13. Place of ERA in Design Cycle
    - what it can and cannot do
    - data requirements
    - relationship to laboratory tests
    - example of how cycle design affects cabinet loads
  - 14. Definition of Base Case for Multiple Pathways Analysis
    - suggested sample cases
    - inputs from workshop attendees
    - attendees assignment
- D. Chinese Multiple Pathways Analysis (3 days)

## Annex 6: Equipment

A. UNDP Input	Activity/Location	Cost
1. 8 Computers; including network cards and network connection hardware, and modems	Project Information Center	\$24,000
2. Computer Software	Project Information Center	\$2,000
3. 3 Computers, including network cards and network connection hardware, and modems	PMO	\$9,000
4. Fax Machine	PMO	\$800
5. Computer Software	PMO	\$1,000
<b>Total</b>		<b>\$36,800</b>



## Annex 7: Description of Incentive Programs

- 15. Review of Sample Problem
  - sample designs developed by attendees
  - select base case problem
  - analyze base case and discuss results
- 16. First Hands-On Design Competition
  - review pathways
  - assess results
  - practical implications
  - user comments
- 17. Second and Additional Design Competitions
- 18. Review Model Strengths and Limitations
  - theoretical bases
  - laboratory vs field studies
  - input/output menus and reports
  - what else is needed
- E. Compressor Model Approaches (1 day)
  - 19. Theoretical Considerations
    - heat transfer paths in compressor
    - review of ORNL and Indian compressor tests and correlations
  - 20. Use of REMAP Program with Compressor Maps
    - technical approach
    - results
    - dealing with limited laboratory data
    - inherent uncertainties and effects on predicted energy use
- F. End of Training Workshop (3/4 day)
  - 21. Introduction to Software Structure
    - module descriptions
    - how programs can be modified
  - 22. Open Discussion and Questions

Task 3: Follow-up

Deliverables and Outcomes:

1. training workshop materials
2. 10 day training workshop for 30 participants
3. sample refrigerator designs
4. design competition methodology and results
5. ERA program and sample files
6. Chinese translation of ERA program documentation

**Estimated Budget:**

Expert (travel and remuneration)	1	mission(s)	\$5,100	\$5,100
Meeting room rental	10	days	\$400	\$4,000
Computer rental (10 days)	30	computers	\$750	\$22,500
AV equipment	10	days	\$120	\$1,200
Telecommunications				\$500
Supplies & materials				\$4,500
Total				\$37,800

**Location:**

China

## Description of Incentive Programs

Incentive programs to be implemented within the China Refrigerator Project are the following:

- Compressor manufacturers' incentive program;
- Refrigerator manufacturers' incentive program; and
- Refrigerator retailer incentive program.

In each case, financial awards will be awarded to provide incentives to change behaviour (in manufacturers and retailers), and to provide any incremental costs to change manufacturing processes.

Detailed technical specifications for each of these programs is described in sections 7.2 – 7.4 below. For additional description of the context for each of these programs, please see the discussion under Output 1.3 for the Compressor manufacturers' program, Output 2.3 and Output 3.2 for the Refrigerator manufacturers' program, and Output 3.4 Refrigerator retailer program.

### 7.1 Implementation Arrangements

Incentive schemes are unusual in UNDP projects. Financial awards are to be given to stores/sellers, individuals and manufacturers. In order to ensure that the right awards are given to the right recipients, and to monitor that the awards have the intended impact, additional implementation arrangements have been developed for these incentives schemes.

The key steps in this process are outlined below. For each scheme, full details will be developed during the project by the PMO, submitted to the Executing Agency, and approved by UNDP.

#### 1. Selection of participants in the programme

In each case a workshop will first be held to advertise and explain the incentive programme. This activity aims at informing the relevant potential participants the goals, requirements and contents of the incentive programs. These workshop may be combined with other activities in the project.

Then, based on the information in the sections 7.2 – 7.4 of this annex and in the relevant sections of the project document, **eligibility criteria** will be formulated. Relevant international and domestic experts will conduct this activity.

Then, potential participants will be selected and provided with general training on how to prepare bids. Participants will then prepare bids. (Note, in the case of refrigerator programme, this training will be intensive and will take place after a pre-selection process- again based on mutually agreed criteria). Bids will be prepared, where necessary with technical assistance from the project. The bids will indicate, *inter alia*, how the bidder is committed to the project. Commitment can be measured in terms of implementing changes in its work procedures resulting in either more production or sales, or

committing the inputs of senior managers and designers to the projects extensive training programme.

## 2 Bidding

The tender will be announced for potential award receivers.

A bid evaluation committee will be formed, including representatives from UNDP, FECO, SALI or other relevant agencies or personnel. Site visits by FECO may be conducted so as to be aware of the progress of the manufacturers in preparing the bids.

The bid opening ceremony. Based on the criteria developed earlier, the bids will be reviewed and the winner(s) identified and selected. Follow-up visits to the sites may be necessary.

The winner/winners of the award will be publicly announced.

## 3 Ensure the relevant reports to UNDP

FECO will ensure UNDP to be informed through following reports and activities:

- Invite representatives of UNDP to participate in initial workshops;
- The bidding document eligibility criteria will be submitted to UNDP for comments, and the finalised version for file keeping;
- Report of site visits will be submitted to UNDP as an information;
- The short list of tenders for project participation will be submitted to UNDP for information;
- The bidding document for incentive program will be submitted to UNDP for information;
- UNDP will be informed the results of bid evaluation through a report, together with an explanation for winners and losers;
- UNDP will be invited to participate in the bid opening ceremony of compressor incentive program.

## 4 Ensure the accountability of funds disbursement to UNDP

UNDP will be informed each disbursement of funds for each incentive program. Receipts will be obtained from award recipients through submitting funds disbursement reports of FECO and the disbursement receipts from compressor manufacturers.

## 5 Monitoring

SEPA will monitor the award recipients. Acceptance of this monitoring will be a condition for receiving the award. At six-monthly intervals after the awards. SEPA will prepare a report to UNDP indicating how the award is being spent, whether the award is being utilised in the manner indicated in the bid, and to what extent the award is achieving its impact.

## 7.2 Compressor manufacturer incentive program

The Compressor manufacturer incentive program will be implemented under Immediate Objective 1. The program's goal is to incentivize and provide incremental cost funding for energy efficiency improvements in compressors. The program is based on work completed under the project preparation facility, including a China compressor sector survey completed by SALI and a technical survey which collected and analyzed incremental cost data for four representative Chinese compressor models covering the two substitute refrigerants currently being adopted in China, R600a (isobutane) and HFC-134a. Both of these reports are presented in the supplemental materials annex.

The compressor manufacturer incentive program will be open to participation by all manufacturers with planned production in China of 500,000 compressors per year for the first year of the program. The total award pool available for compressor manufacturers is \$500,000. This award will be distributed by competitive bid proposal as follows, in two components:

- Principal award of \$400,000 to the manufacturer that commits to develop or acquire and commercialize the most energy efficient compressor technology, as measured by the compressor's coefficient of performance (COP); and
- Secondary award of \$100,000 to the manufacturer that commits to develop or acquire and commercialize the second most energy efficient compressor technology.

Each participant in the bidding will propose one package for each of the above awards. The principal and secondary awards will be made respectively to those manufacturers that propose the most efficient compressors for each of those categories. One manufacturer may receive both awards, as long as the proposals for those awards are not duplicative. In order to encourage adoption of energy efficient technology for each of the two substitute refrigerant types, the potential awardees for the secondary award will receive a COP bonus of 0.05 if the substitute refrigerant technology proposed differs from the one proposed by the principal award winner.

The compressor technology developed or acquired (e.g., via technology transfer license from an international vendor) may consist of a single model or multiple models. The minimum COP proposed is COP of 1.40. For both the principal and secondary awards, proposals will be evaluated and scored as follows:

**(COP of compressor – baseline COP of 1.1) multiplied by the  
Potential market for compressor(s) of that size range**

The potential market for compressor(s) of that size range will be calculated using data for either 1996 (see sample data attached), or for a more recent year if such data is available, based on the distribution of refrigerator sales by volume and the input power of compressors which matches that refrigerator volume. This calculation method will encourage compressor manufacturers to develop or acquire energy efficient compressor technologies that have significant market share potential.

### 7.3 Refrigerator manufacturer incentive program

This program focuses on refrigerator manufacturers and will be implemented in conjunction with the refrigerator manufacturers' training program and technical assistance described under Objective 2. The program is designed to offer incentives to refrigerator manufacturers to offset the incremental costs of their participation in the project, thus reducing the risk to manufacturers of developing and introducing new energy efficient products.

Under this activity, refrigerator manufacturers will submit closed competitive bids for funding of their projected incremental costs to develop, produce, and market energy efficient products. The bidding procedure will be structured so as to maximize the efficiency gains and concomitant carbon emissions reductions attributable to the measures implemented and market penetration of the resulting higher efficiency models. Tracking of results will take place over a three-year period beginning after bids are awarded.

In order to maximize the energy efficiency gains and carbon emissions reductions achieved by the program, awards will be competitively made at multiple award levels. The basic award level will be approximately RBMY 1 million (US\$120,000). Based on refrigerator sector data collected and discussions with manufacturers, this amount is equivalent to the minimum expected incremental cost of designing, developing, and commercializing an energy efficient refrigerator (including manufacturer opportunity cost for corporate resources invested in design and commercialization of energy efficient models, which is higher than for non-efficient models due to unfamiliarity with energy efficiency design approaches).

Up to eleven of these awards will be provided to manufacturers based on a minimum level of energy savings (discussed further below) which participating manufacturers must commit to. Provision of this guaranteed incentive funding amount to participating manufacturers will allow those manufacturers to participate in the project and initiate development of energy efficient models with reduced design and commercialization risk, and will involve a variety of manufacturers in design, production, and sale of more energy efficient refrigerators. In return for committing to achieve this basic level of energy savings, manufacturers will also be able to participate in other project activities and programs (e.g., training program, retail sales incentive eligibility for manufacturer's products, participation in promotional programs, etc. ).

The principle award will be in the amount of US\$1 million, which will be awarded to the manufacturer who proposes the single most energy efficient model, and commits to commercialization and sale of that model such that the total energy savings (savings per refrigerator times total domestic sales commitment) exceeds the amount proposed by all other manufacturers. The amount of this award has been determined on the basis of the expected incremental cost to design and widely commercialize (i.e., sell significant numbers of) a highly energy efficient refrigerator. Each of these award types is described further below.

#### Basic award

As a condition to participating in the manufacturer incentive program, all participating manufacturers will commit to the following:

- Design, build, and commercialize one new energy efficient refrigerator model, such that that refrigerator's energy use will be at least 20% more efficient<sup>5</sup> than allowed by the project standard<sup>6</sup> for that model (see description of calculation method below); and
- Not exceed the average energy use target level for all of their production models on a production weighted basis (see description of calculation method below).<sup>7</sup>

Each participating manufacturer that commits to the above will be guaranteed receipt of funding equal to the basic award. In addition, participating manufacturers may also receive additional incentive funding, up to and including the principle award (further described below), or additional basic funding. The additional basic funding will be awarded in three or more awards of approximately RMBY 500,000 (\$60,000) to those manufacturers that commit to the greatest energy savings relative to their existing product lines. Participating manufacturers will bid packages of measures in RMBY 500,000 increments (each manufacturer may submit more than one package) that will reduce the total rated energy use<sup>8</sup> of refrigerators they produce over the three year program tracking period (relative to 1996, or for manufacturers that were not in existence prior to 1996, relative to their first production year). Supplemental awards will be issued to those manufacturers that commit to and achieve the greatest reductions.<sup>9</sup>

The number and amount of these additional basic awards will be determined by the final number of participating manufacturers. For example, if the maximum number of 11 manufacturers each receives the basic award of approximately RMBY 1 million (\$120,000) basic award, then an additional \$180,000 will be available for distribution from the \$1.5 million basic award pool. This would allow three additional incentive awards of approximately RMBY 500,000 (\$60,000) each.

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<sup>5</sup>Please note that this compares to the current average energy use of 22% below the project standard for those models that exceeded the standard for the 1996 production year. Given the intensive training and technical assistance which participating manufacturers will receive, this requirement should therefore be achievable by all participating manufacturers.

<sup>6</sup>The project standard is linked to the proposed new Chinese standard allowance. Though the latter standard has not been adopted at the time of this writing and may be further revised prior to adoption, it is used here only for calculation purposes and as a reference. The project standard is independent of the form in which the new Chinese national standard is ultimately adopted.

<sup>7</sup>Alternatively, the documents provided to manufacturers may specify a comparable level of energy efficiency in terms of the A-B-C rating system currently under consideration for adoption in China.

<sup>8</sup>Rated energy use is daily energy use as tested and certified by a Chinese national testing agency.

<sup>9</sup>In order to receive this additional funding, the recipient manufacturer must achieve energy efficiency gains beyond those specified in the minimum commitment above. For purposes of determining the recipient of this award, total energy saved will include energy saved as a result of the manufacturer's efforts to achieve the minimum savings necessary to participate in the project. Reductions in total production-weighted energy use are to be attributable to redesign of existing models and/or production of more efficient models in place of less efficient ones, not to an overall reduction in total production levels. Similarly, manufacturers whose production levels increase relative to the base year will not be penalized. This will be accomplished by scaling energy savings to tracking period production based on production-weighted average energy use relative to target energy use for base and target years (see section below regarding awarding supplemental awards).



Target energy use calculation

The project's target energy use allowance is calculated as follows for each model:

$$EU = M * AV + N$$

where AV is Adjusted Volume, M (the volume factor) equals 0.657, and N (the constant) is 235.

Adjusted volume is calculated as follows:

$$AV = FVAF * FR + FF$$

where FVAF (Freezer volume adjustment factor) is 2.15, FR is freezer volume, and FF is fresh food compartment volume.

The above calculation can be made for an individual model, or used to calculate average energy efficiency for a manufacturer's entire production line. The following example shows how the latter calculation is made for a hypothetical product line.

Model	BCD-160	BCD-180	BCD-200	BCD-220	BCD-240	BCD-260	Totals/Averages
Energy Use (kWh/Day)	1. 1	1. 2	1. 3	1. 4	1. 5	1. 6	1. 35
Output (Thousands)	50	50	50	50	50	50	300
Production-Weighted Enuse (Mwh P. A. )	20,075	21,900	23,725	25,550	27,375	29,200	147,825
Total Volume	160	180	200	220	240	260	210
Freezer Volume (L)	50	60	70	80	90	100	75
Fridge Volume	110	120	130	140	150	160	135
Adjusted Volume	218	249	281	312	344	375	296
Annual Enuse Allowance	378	399	419	440	461	481	430
Annual Enuse (kWh/Year)	402	438	475	511	548	584	493
Energy Use Relative To Allowance	6%	10%	13%	16%	19%	21%	15%
Production-Weighted Enuse Allowance (Mwh P. A. )	18,895	19,930	20,964	21,999	23,034	24,069	128,891

Principle award

The principle award will be awarded to the manufacturer that designs and commits to manufacture and market the refrigerator that delivers the greatest total energy efficiency gains and carbon emissions reductions for the amount of the prize, as follows:

Total energy efficiency gain = Unit energy efficiency gain \* Sales commitment

The sales commitment shall be for any four consecutive quarters within a three-year period after the award is issued. Energy efficiency gains will be measured relative to the new proposed minimum efficiency standard, as follows:

Unit energy efficiency gain = (Baseline energy use) - (Actual energy use).

Actual energy use will be rated energy use as calculated by a national testing agency in China in accordance with national testing standards. Baseline energy use is calculated as

$$EU = M * AV + N$$

where AV is Adjusted Volume, M (the volume factor) equals 0.657, and N (the constant) is 235.

Adjusted volume is calculated as follows:

$$AV = FVAF * FR + FF$$

where FVAF (Freezer volume adjustment factor) is 2.15, FR is freezer volume, and FF is fresh food compartment volume.

In addition, the proposed refrigerator model must meet the following requirements:

- the unit must be a refrigerator-freezer;
- total (unadjusted) volume must be greater than 200 liters; and
- the unit must be certified to meet both Chinese and international safety standards.<sup>10</sup>

Funds for the award will be issued after the sales target is met for the energy efficient model which the winning manufacturer proposes. The principal award recipient shall not receive a basic award in addition to the principal one.

Program budget by funding source and activity

Element	GOC	Local	Bilat- eral	GEF	Total
Basic/supplemental award pool	-	-	-	1,500,000	1,500,000
Principle award	-	-	-	1,000,000	1,000,000
Manufacturer work-shops	100,000	-	-	-	100,000
Program total	100,000	-	-	2,500,000	2,600,000
Note: Program implementation support, bid evaluation, bid results tracking, and program evaluation will be funded under Objective 5.					

<sup>10</sup> The international safety certification may be either U.S., European Union, or Japanese.

### Awarding supplemental awards

As described in the body of the program description, there will be at least three \$60,000 supplemental basic funding awards, based on a total of 12 participating manufacturers. These three awards will be issued to at least three separate manufacturers. If there are fewer than 12 participating manufacturers, more basic incentive funding will be available for distribution as supplemental awards. For example, if only a total of 11 manufacturers participate in the program, 10 basic \$120,000 awards will be issued, leaving a total of \$300,000 available in the basic award pool for five supplemental awards. Up to two of those additional supplemental awards may then potentially be issued to manufacturers who have already received other supplemental awards. The formula to determine how many of the supplemental awards shall be issued to separate manufacturers is (Total number of supplemental awards) divided by two and rounded up to the greater of the nearest whole number or three, such that at least half and no less than three of the supplemental awards will be distributed to separate manufacturers. The purpose of this approach is to ensure some broad distribution of those awards while still allocating awards on the basis of cost effectiveness, rather than to allow their concentration solely in the hands of one manufacturer.

### Supplemental award scaling system

Reductions in total production-weighted energy use must be attributable to redesign of existing models and/or production of more efficient models in place of less efficient ones, not to an overall reduction in total production levels. Similarly, manufacturers whose production levels increase relative to the base year should not be penalized. This can be accomplished by scaling energy savings to tracking period production, based on production-weighted average energy use relative to target energy use for base and target years, calculated as follows:

$$\text{Scaled energy savings} = (\text{Change in Performance Delta}) * (\text{Program Year Target Energy Use})$$

where (Change in Performance Delta) = (Base Year Performance Delta) - (Program Year Performance Delta), and (Performance Delta) = (Energy Use)/(Target Energy Use Allowance) - 1. A Performance Delta (PD) greater than zero indicates that the model in question (or the production-weighted average of the models in question) consume more energy than permitted under the target energy use allowance. PD less than zero indicates that the model or models in question are more efficient than the target energy use allowance.

This calculation and the reason for it are illustrated in the table below. The calculation can be made for a single program year, or for several, since it is not dependent on absolute production levels in either the base or program years.

In this example, Bid 1 shows nominal energy savings. These savings are however entirely attributable to a decrease in production -- the units produced were actually identical in energy use to those produced in the base year. Bid 2, on the other hand, improved energy

performance relative to the performance target by 10%, but shows negative savings due to increased production levels. The scaling calculation corrects this, showing what the total energy savings given current production levels. Simultaneously, this calculation method corrects any effective volume penalty which manufacturers would otherwise be subject to for increasing their average refrigerator volume relative to the base year. Market research has demonstrated that this increase in consumer demand is a pre-existing external market trend, and it is therefore not the project's goal to attempt to counteract this trend.

### Supplemental Award Scaling System

Item	Bid 1	Bid 2
Base year production	100,000	100,000
Base year energy use	56,210,000	53,655,000
Base year target energy use allowance	51,100,000	51,100,000
Performance delta	10%	5%
Program year(s) production	50,000	150,000
Program year(s) energy use	28,105,000	72,817,500
Program year(s) target energy use allowance	25,550,000	76,650,000
Performance delta	10%	-5%
Nominal energy savings	28,105,000	(19,162,500)
Energy efficiency gain	-	10%
Scaled energy savings	-	7,665,000

This approach will also be used to evaluate separate measures proposed by manufacturers to improve the efficiency of individual models, since manufacturers may submit and receive funding for more than one proposal. Each of these measures will be evaluated in terms of its effect on the manufacturer's average scaled production-weighted energy efficiency, as shown in the example below.

Evaluation of measures based on improving individual models

Model	BCD-160	BCD-180	BCD-200	BCD-220	BCD-240	BCD-260	Totals/Averages
Energy Use (kWh/day)	1.10	1.20	1.30	1.40	1.50	1.60	1.35
Annual Enuse (kWh/year)	402	438	475	511	548	584	493
Base Year (1996) Output	50,000	50,000	50,000	50,000	50,000	50,000	300,000
Production-weighted Enuse (mWh p.a.)	20,075	21,900	23,725	25,550	27,375	29,200	147,825
Total Volume	160	180	200	220	240	260	210
Freezer Volume (L)	50	60	70	80	90	100	75
Fridge Volume	110	120	130	140	150	160	135
Adjusted Volume	218	249	281	312	344	375	296
Annual Enuse Allowance	378	399	419	440	461	481	430
Delta	6%	10%	13%	16%	19%	21%	15%
Production-weighted Enuse Allowance (mWh p.a.)	18,895	19,930	20,964	21,999	23,034	24,069	128,891
Program year production	25,000	25,000	50,000	75,000	100,000	125,000	400,000
Program year energy use	10,038	10,950	23,725	34,979	50,214	48,138	178,043
Program year target energy use allowance	9,447	9,965	20,964	32,999	46,068	60,172	179,615
Delta	6%	10%	13%	6%	9%	-20%	-1%
Nominal energy savings	10,038	10,950	-	(9,429)	(22,839)	(18,938)	(30,218)
Scaled energy savings	-	-	-	3,346	4,536	24,863	32,745

Note that of the six models in this sample production line (the same models in the example above), the manufacturer is only planning to upgrade three. If this is the manufacturer's entire current and planned production line, the combination of these measures will allow the manufacturer to meet both of his basic project requirements: average production-weighted fleet efficiency has reached the target energy efficiency level, and the manufacturer has developed or modified one new model that exceeds the project target by 20%. Assuming however that the manufacturer had other models that allowed those requirements to be met and that the above model improvements were under consideration solely in conjunction with the supplemental award bid, the manufacturer could propose all three

modified models as a package for possible supplemental funding, or could propose them individually, or could group them in two separate proposals. For example, submitting all three measures as a package would maximize the manufacturer's chance of receiving one supplemental award, but would forgo any possibility of receiving a second award.

The above manufacturer might bid the BCD-260 and BCD-220 together as one package, and the BCD-240 as another. Evaluation would be based on energy savings committed to, based on the fleet average times projected output (as calculated above and in the previous table). Upon implementation, the manufacturer would still be free to react to changes in the market or technological advances by substituting other models or changing production levels, so that the average fleet efficiency gain and the production level might change. This would be acceptable and that manufacturer would still be in compliance with its commitment, as long as the total energy savings commitment was still met.

Please note that the supplemental award is based on gains relative to actual base year energy efficiency, not on average fleet levels relative to the baseline as with the baseline award. These two approaches are different, but not contradictory. The baseline award encourages and provides incremental funding for average energy efficiency gains up to and including a set minimum level. The supplemental award encourages and provides incremental funding for cost effective efficiency gains *beyond* that level, since manufacturers have an additional incentive to bid efficiency upgrades up to and including the marginal cost of each award (\$60,000).

That the basic and supplemental awards potentially (but don't necessarily) overlap (i.e., a manufacturer might bid some or all of the same measures for the supplemental award that it commits to undertake in order to meet the baseline commitment) effectively provides additional possible funding to those manufacturers whose model lines require the most upgrades, which correlates with the higher incremental costs of those manufacturers. Furthermore, since all participating manufacturers must commit to the target energy efficiency level, all manufacturers who bid have an incentive to bid at least that level of efficiency gains for supplemental funding. Please note also that the principal award winner is awarded the principle award and does not receive the \$120,000 basic award in addition to the latter. However, the principal award winner may compete for and receive supplemental basic awards.

#### 7.4 Refrigerator retailer incentive program

Dealers and sales personnel have determinative influence on the consumer's purchase decision. Therefore, it is crucial to provide dealers and salespeople with the necessary knowledge and information materials to introduce energy efficient refrigerators to the prospective purchaser.

Given the current low penetration rates of energy efficient refrigerators, market research conducted under the PDF (see market research report attached in the supplemental materials annex of the GEF brief, Annex 4.5) demonstrates that it is also necessary to provide retailers with direct incentive to sell energy efficient models, thus reducing dealers' and

sales personnel's perceived risk and opportunity costs to market such products. The dealer incentives developed to address these issues under this activity include:

- cash awards for individual sales staff for the most energy efficient refrigerators sold during a particular period;
- cash awards to stores and dealerships for the most energy efficient refrigerators sold during a particular period;
- non-cash awards such as free merchandise and travel; and
- other forms of recognition (e.g., plaques, program memorabilia, awards, etc.) for individual sales, stores, and dealerships for participation in the program and achieving sales targets for energy efficient refrigerators.<sup>11</sup>

Direct program costs including program development and administration are shown in the table below for an initial pilot program in five target cities, followed by a three-year nationwide rollout:

#### Program Budget for Dealer Incentive Program (in USD)

Cost Item	Number	Unit	Unit Cost	Total Cost
Pilot program top salesperson (one winner per contest)	5	people	\$1,000	\$5,000
Pilot program second prize (4 winners per contest)	20	people	\$100	\$2,000
Pilot program top store (one winner per contest)	5	stores	\$5,000	\$25,000
Pilot program award dinner/workshop (for 5 separate contests in 5 cities)	5	events	\$2,600 <sup>12</sup>	\$13,000
Regional program top salesperson (one winner in each of 24 contests)	24	people	\$1,000	\$24,000
Regional program second prize (4 winners per contest)	96	people	\$100	\$9,600
Regional program top store (one winner per contest)	24	stores	\$5,000	\$120,000
Regional program award dinner/workshop (for 3 contests in each of 8 regions)	24	events	\$2,600	\$62,400
National program top salesperson (one winner per contest)	3	people	\$2,000	\$6,000

<sup>11</sup> Cash awards for stores and individual sales staff per energy efficient refrigerator sold were considered and rejected due to higher cost effectiveness of the activities described herein.

<sup>12</sup> Based on seven plaques/certificates at ¥100 each, ¥1,000 space rental, and workshop material and meal costs of ¥200 each for 100 participants on average for total workshop costs of ¥21,700 (US\$2,600).

Cost Item	Number	Unit	Unit Cost	Total Cost
National program second prize (4 winners per contest)	12	people	\$200	\$2,400
National program top store	3	stores	\$10,000	\$30,000
National program award dinner/ workshop (one per year)	3	events	\$5,200	\$15,600
Program administration	3	years	\$10,000	\$30,000
Program development (including pilot program administration)	1	time	\$20,000	\$20,000
Total				\$365,000

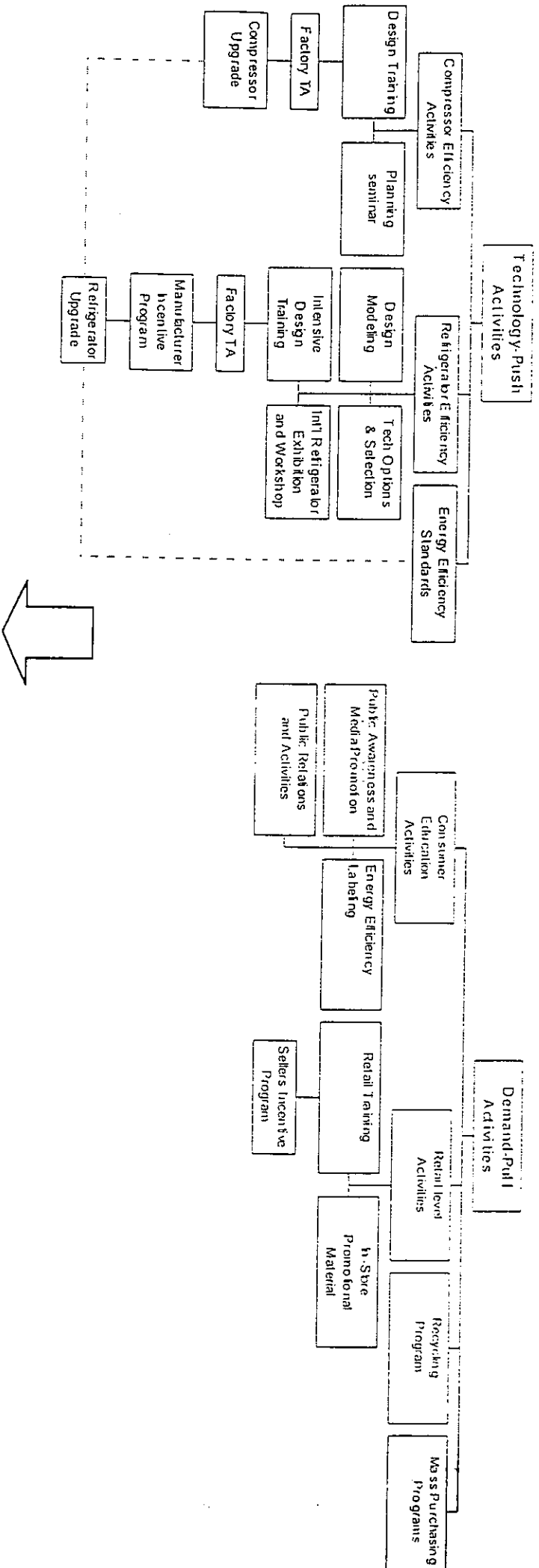
These award levels, in conjunction with non-monetary recognition (plaques, announcements, etc.), training, and supporting materials, should provide dealers and salespeople with adequate incentives and capability to promote sales of energy efficient refrigerators.

Based on China Statistical Bureau survey of 100 major stores, average store sales figures are 200-300 units per month. According to a sales manager interviewed in conjunction with preparation of the project brief, the peak seasons for the refrigerator sales (in Guangzhou, one of the principle target markets) are May-August and January-February. Sales at this representative large store in Guangzhou average 20 units per day during non-peak periods, increase somewhat during the former peak sales period, and double during the latter period. To take advantage of these peak periods, sales contests will be structured to end at the end of August and February respectively.



## Annex 8: Project Strategy Schematic

# Annex 8: Project Strategy Schematic



Market Transformation

## Attachment 1

### Capacity Building for national execution

#### Key consideration

*Energy efficient refrigerator project is very likely to be the first UNDP/GEF project executed by national agency. FECO understands that if it decides to take the responsibility of national executing agency, it will be obliged to take overall responsibility for the organization and management of project activities, reporting, accounting, monitoring, and evaluation of project, for supervision of the implementing agents, and for the management and audit of the use of UNDP/GEF resources. Based on these considerations, FECO has carefully reviewed the Annex A, the capacity building for execution: key considerations. It fully understands the capacity needs listed in this annex. The following items listed below are FECO's comments to key considerations in Annex A.*

#### **Technical capacity,**

Comments: FECO has the required capacity to complete the tasks described in clause 1- 3. FECO's established facilities, accumulated know-how from executing MP, WB projects, makes it the appropriate and optimal choice to take these tasks. However, considering the fact that project could be the first UNDP/GEF project executed by national agency, and we are not very familiar with concrete requirements and internal procedures of UNDP, FECO needs more detailed information from UNDP for clause 2, including format, due date, and other requirements concerned.

#### **2. Managerial capacity**

Comments: There is no doubt that FECO possesses this capacity. It has well-qualified employees, who were selected through tough competition. It has accumulated abundant experience in project management and coordination, and many internal management and coordination procedures targeted at efficiency improving have also been established, particularly in the fields of planing, monitoring and coordinating. However, to be better aware of the requirements from UNDP, we would like to have some training on the use of some office software such as Microsoft project and etc, and on the other detailed requirements of UNDP.

#### **3. Administrative capacity**

**Ability to procure goods, services, and works on transparent and competitive basis**

Comments: Inside FECO, there is a special division dealing with procurement. Hundreds activities of procurement worth US dollar of tens of millions have been completed by FECO. To support this project, personals from this division will also join the execution work of this project, undertaking relative procurement work.

Clause 1,2,3 No problem

#### **Ability to prepare authorizes and adjusts commitments and expenditures**

Comments for clause 1: FECO has its own procedures for identifying vendors, obtaining the best price, and issuing commitments. We would like to know in more detail the requirements of UNDP in this regard.

Comments for clause 2: If we execute this project, necessary measures including regular site visits will be conducted to track the progress of the activities in this project, track and solve any problems emerged in the process of project execution. Besides, special attention will be paid in the contract to avoid overspending through some punish measures. We would like to know in more detail the requirements of UNDP in this regard.

#### **Ability to manage and maintain equipment**

Comments for clause 1, No problem. Within SEPA, there is a property ledger system for administration, which, in our view, is quite strict. We can use it for reference and form the property ledger system of the project.

Besides, property procurement is only a minor part in this project.

Comments for clause 2. FECO will take the responsibility of recruiting domestic experts. FECO has won widely recognized reputation in this regard. With regard to recruit international consultants or experts, considering UN specialized agencies have comparative advantages to fulfil this task we may request UN specialized agencies to undertake this task.

Comments for clause 3. No problems within and outside FECO. Within FECO, more staff will be distributed to this project to strength the procurement and financial capacity. The current restructuring of SEPA provides FECO the best opportunity to do so.

Comments for clause 4. No problems, we will strictly follow the terms of references and are willing to provide help to the experts whenever and wherever they need.

5. Comments for clause 5. No problem

### **4. Financial Capacity**

#### **Ability to produce programme/project budgets**

Comments for clause 1. Within FECO, there is a special division dealing with financial issues. A working team within FECO will be formed, including project officials, financial staffs and procurement staffs. Given the large number of projects executed by FECO, in terms of both financial and procurement management, there is no reason to doubt FECO's capacity in this regard. However, to be better aware of the UNDP's internal requirements, training in this regard is welcomed.

Comments for clause 2. No problem, we will do so.

#### **Ability to ensure physical security of advances, cash and records.**

Comments for clause 1. Absolutely no problem, we will certainly do so.

Comments for clause 2. FECO has an internal procedure in this regard. The disbursement of funds is strictly under control within and outside FECO. Without authority of NPD, no disbursement can be made.

#### **Ability to disburse funds in a timely and effective manner**

Comments for clause 1. We'll do so; training in this regard will be welcomed.

Comments for clause 2. No problem, a reputable independent bank will be selected.

Comments for clause 3. We'll do so. Receipts are strictly verified within FECO. More detailed information will be welcomed.

Comments for clause 4. No problem, training in this regard will be welcomed.

Comments for clause 5. We'll do so. Training in this regard will be appreciated.

**Ability to ensure financial recording and reporting**

Comments for clause 1, no problem, training is welcomed so as to be aware of detailed requirements of UNDP.

Comments for clause 2, no problem, we'll do so.

**Attachment 2 INCREMENTAL COST/BENEFIT TABLE**

Component	BASELINE	ALTERNATIVE	INCREMENT
Component 1: Compressor Factory Conversion	<p>Global: Current compressor designs inefficient- more efficient designs not available</p> <p>Domestic: Producers use existing designs</p> <p>Cost: US\$1,579,500</p>	<p>Global: Compressor manufacturers learn to make efficient designs</p> <p>Domestic: Producers improve designs</p> <p>Cost: US\$2,432,000</p>	<p>Global: Chinese industry able to design more efficient refrigerators</p> <p>Domestic: Efficient compressors available to manufacturers</p> <p>Cost: US\$852,500</p>
Component 2: Refrigerator Factory Conversions	<p>Global: Refrigerator producers continue producing inefficient designs</p> <p>Domestic: Manufacturers use existing facilities and designs</p> <p>Cost: US\$24,265,000</p>	<p>Global: Refrigerator producers helped re-design factories for more efficient refrigerators</p> <p>Domestic: Manufacturers invest in production of more efficient refrigerators</p> <p>Cost: US\$25,768,090</p>	<p>Global: Refrigerator Producers shift to production of efficient refrigerators</p> <p>Domestic: New investments in new factories</p> <p>Cost: US\$1,503,090</p>
Component 3: Incentive Programs	<p>Global: Producers and sales staff lack incentives to produce and sell more efficient refrigerators and will not make investments to do so</p> <p>Domestic: Sales of inefficient refrigerators continues</p> <p>Cost: US\$660,000</p>	<p>Global: Incentive systems induce refrigerator producers to produce and sell more efficient refrigerators</p> <p>Domestic: Increased sales of more efficient refrigerators</p> <p>Cost: US\$3,755,000</p>	<p>Global: Market for efficient refrigerators grows on supply side</p> <p>Domestic: Producers see economic value in more efficient design</p> <p>Cost: US\$3,095,000</p>
Component 4: Consumer Education Program	<p>Global: Consumers unaware of advantages of more efficient models</p> <p>Domestic: No sales of more efficient refrigerators</p> <p>Cost: US\$4,450,000</p>	<p>Global: Consumers educated about costs and savings of efficient models</p> <p>Domestic: Consumers begin to buy more efficient refrigerators</p> <p>Cost: US\$7,434,940</p>	<p>Global: Demand-side of market transformed</p> <p>Domestic: Market for efficient models created</p> <p>Cost: US\$2,984,940</p>

<b>Component 5: Monitoring and Evaluation</b>	Global: Information on refrigerator performance & sales lacking Domestic: No info required  Cost: US\$335,000	Global: Information on project activities is available Domestic: Adequate monitoring  Cost: US\$804,100	Global: Information on transformation of market made available Domestic: Market transformation tracked Cost: US\$469,100
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**Incremental Cost Matrix (continued)**

<p><b>TOTAL PROJECT</b></p> <p><b>Global Environmental Benefits</b></p>	<p>Barriers prevent the improvement of energy efficiency in refrigerator sector</p> <p>Per household: 12.4 tons CO<sub>2</sub> emitted due to refrigeration over 15 years</p> <p>20 million households: Approximately 250 million tons CO<sub>2</sub> Emissions over 15 years</p>	<p>Barriers to improved energy efficiency of refrigerators removed</p> <p>Per household: 7.4 tons CO<sub>2</sub> over 15 years</p> <p>20 million households: Approximately 150 million tons CO<sub>2</sub> emissions over 15 years</p>	<p>Barriers removed—refrigerator market transformed to more efficiency model</p> <p>Per household: 5.0 tons CO<sub>2</sub> emissions avoided over 15 years</p> <p>20 million households: Approximately 100 million tons CO<sub>2</sub> avoided emissions over 15 years</p>
<p><b>Domestic Benefits</b></p>	<p>Refrigeration for 15 years</p>	<p>Refrigeration for 15 years</p> <p>Avoided electric power system costs of 220 kWh/yr less electricity consumption for 20 million households</p> <p>Increased competitiveness of domestic manufacturers in international markets</p>	<p>Avoided electric power system costs of 220 kWh/yr less electricity consumption for 20 million households</p> <p>Increased competitiveness of domestic manufacturers in international markets</p>
<p><b>Costs</b></p>	<p>Per household: ¥5030 lifecycle costs</p> <p>Participants will spend about \$31.3m on factories and refrigerator design</p>	<p>Per household: ¥4890 lifecycle costs</p> <p>Project costs of US\$40.9 million to reduce barriers</p>	<p>Per household: ¥140 lifecycle costs savings</p> <p>Incremental project costs of US\$9.6 million to remove barriers</p>



Attachment 3: Project Planning Matrix

Project Strategy	Objectively Verifiable Indicators	Means of Verification	Assumptions
<p>Development Goal:</p> <p>Promote the adoption of energy-efficient designs and technologies in the refrigerator industry in China and build a domestic market for high-efficiency models</p>	<p>1. Market share of energy-efficient refrigerators relative to less-efficient models</p> <p>2. Number of dealers and distributors that are stocking and selling energy-efficient refrigerators</p> <p>3. Average efficiency levels for Chinese refrigerators relative to past levels and to levels in other countries</p>	<p>a. Market surveys</p> <p>b. Information provided by dealers</p> <p>c. Manufacturer production and sales data</p>	<p><i>i. Household refrigerators are a large opportunity and priority for reducing greenhouse gas emissions</i></p> <p>ii. More-efficient refrigerator designs and an expanded domestic market for high-efficiency refrigerators will result in reduced greenhouse-gas emissions</p> <p>iii. Availability of higher efficiency models doesn't significantly influence the purchased refrigerator size (same size purchased as baseline), or decision to keep old refrigerator service.</p>

Project Strategy	Objectively Verifiable Indicators	Means of Verification	Assumptions
<p>Project Purpose:</p> <p>Reduce key market, technological, social, and commercial barriers both to adoption of high-efficiency refrigerator technology by manufacturers and acceptance of high-efficient refrigerators by Chinese consumers</p> <p>These barriers include:</p> <ul style="list-style-type: none"> <li>a. More-efficient compressors are not available domestically</li> <li>b. Consumers aren't aware of the life-cycle benefits of energy-efficient refrigerators</li> <li>c. Manufacturers uncertain if market demand exists</li> <li>d. Manufacturer uncertainty over cost-effectiveness of new technology</li> <li>e. Consumers lack specific information about life-cycle costs of models</li> <li>f. Lack of appropriate standards</li> <li>g. No national certification of energy-efficiency labels</li> <li>h. Dealer reluctance to stock high-efficiency models</li> </ul>	<ol style="list-style-type: none"> <li>1. Availability of energy efficient compressors domestically</li> <li>2. Consumer understanding of benefits of energy efficiency</li> <li>3. Manufacturers anticipation of expanding market for energy efficient products</li> <li>4. Manufacturers plans to produce energy-efficient models</li> <li>5. Nationally certified energy-efficient label developed</li> <li>6. Labeling of new refrigerators (energy-efficient refrigerators sold carry labels giving annual operating costs compared to "average")</li> <li>7. New standards enacted and implemented</li> <li>8. Manufacturer anticipation of stricter standards in the future</li> <li>9. Number of dealers stocking new energy-efficient models</li> <li>10. Dealer incentive program exists</li> </ol>	<ul style="list-style-type: none"> <li>a. Consumer surveys</li> <li>b. Manufacturer surveys</li> <li>c. Dealer surveys</li> <li>d. Market surveys</li> </ul>	<ul style="list-style-type: none"> <li>i. The rising price of electricity towards a level reflecting true costs of production also increases demand for energy-efficient refrigerators</li> <li>ii. Barrier-reduction necessity: market responses will be reduced or delayed unless at least these key barriers are reduced</li> <li>iii. Barrier sufficiency: reduction of identified key barriers to a sufficient degree will result in market responses; other barriers not addressed by the project are not critical to achieving market responses.</li> <li>iv. Barrier reduction sustainability: consumer awareness of life-cycle benefits grows; standards and label programs remain in place; energy-efficient technology remains cost-effective for manufacturers; dealers continue to promote energy-efficient models</li> <li>Higher first costs not a critical barrier</li> <li>v. Higher first costs not an absolute barrier, if other barriers are removed or reduced.</li> </ul>

Project Strategy	Objectively Verifiable Indicators	Means of Verification	Assumptions
<p>Outputs and Activities (see below):</p> <ol style="list-style-type: none"> <li>1. Compressor Factory Technical Assistance</li> <li>2. Refrigerator Factory Technical Assistance</li> <li>3. Incentive Programs</li> <li>4. Consumer Education Program</li> <li>5. Project Management, Monitoring, and Evaluation</li> </ol>	<ol style="list-style-type: none"> <li>1. Compressor factories converted and able to begin production</li> <li>2. Refrigerator factories converted and able to begin production</li> <li>3. Incentive programs in place and operating</li> <li>4. Consumer education campaigns conducted</li> <li>5. Project management in place and operating; project evaluations conducted</li> </ol>	<ol style="list-style-type: none"> <li>a. Contractor/consultant reports</li> <li>b. Factory reports and inspections</li> <li>c. Samples of media reports and presentations</li> <li>d. Consumer surveys</li> <li>e. Project management and evaluation reports</li> </ol>	<ol style="list-style-type: none"> <li>i. Project budget sufficient to produce these outputs</li> <li>ii. Project management equipped, trained, and capable of producing outputs</li> <li>iii. Manufacturers are capable of making the necessary conversions with appropriate technical assistance and financing</li> <li>iv. Labeling can be applied nationwide</li> <li>v. All 12 major manufacturers can be targeted</li> <li>vi. Pilot program of dealer incentives can be replicated nationwide</li> </ol>