



**GEF**



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**Government of India  
and  
United Nations Development Programme  
Global Environment Facility**

**PROJECT DOCUMENT**

**Achieving Reduction in GHG Emissions Through  
Advanced Energy Efficiency Technology in  
Electric Motors**

**August 2008**

**NEW DELHI**

**United Nations Development Programme  
India**

**Project Title:** Achieving Reduction in GHG Emissions Through Advanced Energy Efficiency Technology in Electric Motors

**UNDAF Outcome(s):** Communities are aware of their vulnerabilities and adequately prepared to manage (and reduce) disaster and environmental related risks.

**Expected CP Outcome(s):** Progress Towards Meeting the National Commitment under multilateral environmental agreements.

**Expected Output(s):** National efforts supported to leverage environmental finance to address climate change, biodiversity, land degradation and chemical management issues.

**Implementing Partner:** Bureau of Energy Efficiency, Ministry of Power

**Responsible Party:** International Copper Promotion Council (India)

**Brief Description**

Introduce Copper Motor Rotor (CMR) technology for high pressure copper die casting for manufacturers of copper cast rotor and electric motors to achieve energy savings and achieve reduction in Greenhouse Gases (GHG) Emissions associated with the electric motor industry. This will result into direct GHG emission reductions of up to 15,000 tons CO<sub>2</sub>e during project life time and 360,000 tons over 10 year period.

Programme Period:	2008-2012	2008 AWP budget:	US \$ 100,000
Key Result Area (Strategic Plan):	Mainstreaming Energy and environment.	Total resources required:	US \$1,364,000
Atlas Award ID:	00047661	Total allocated resources:	
Start date:	August 2008	• Regular - GEF	US \$ 250,000
End Date:	July 2011	• Other:	US \$1,114,000
PAC Meeting Date:	19 Sep. 2008	o Donor	-
Management Arrangements:	National Execution	o Donor	-
		o Donor	-
		o Government	-
		Unfunded budget:	Nil
		In-kind Contributions:	-

Agreed by (Implementing Partner): Bureau of Energy Efficiency, Ministry of Power 

Agreed by: Country Director, UNDP 

22.8.2008

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## **1. PROJECT OVERVIEW:**

### **1.1 Situation Analysis:**

India faces chronic electricity shortage (of about 10%) and up to 20% during peak periods. At the same time, the actual per capita consumption has grown from 140 kWh in 1980 to 500 kWh in 2003 and expected to grow to around 800 kWh by 2012. Of the total electricity consumption in India, motors consume almost 35%. Motors are used mainly in industrial and agricultural sectors. Most of the energy is consumed by low-voltage motors of up to 37.5 kW size which offer maximum potential for energy savings. One of the ways to address the problem of energy shortage is to reduce demand mainly by increasing end use efficiency.

### **1.2 Rationale for the Project:**

In order to improve the market penetration of energy efficient motors, the Bureau of Energy Efficiency (BEE) is developing a labeling program for motors under the Energy Conservation Act 2001. As per the Bureau of Indian Standards (BIS) product specifications IS 12615 – 2004, an energy efficient motor is defined similar to European standards and therefore, currently, only a select group of manufacturers produce energy efficient (EE) motors. To meet the high efficiency (rated Eff1) standard, manufacturers generally employ a range of improvements in materials, design & manufacturing methods and quality control that collectively reduce the motor's losses and boost its operating efficiency to the required standard. As per the manufacturers' feedback, a sale of these EFF1 motors is only approximately 2% of the total sales. The major reason identified for low sales is higher initial cost. Hence there is a need to develop technology which can reduce the initial cost of EFF1 motors.

As per the motor design experts, the initial cost of energy efficient induction motors can be reduced by using the copper die-casting technology for the rotors instead of Aluminum die-cast rotors. This will also help reduce the size of the motors for the same output and thus the active material and material cost.

While the stator windings in an induction motor are normally of copper, the rotors are invariably made of die-cast aluminum [ease of die casting aluminum due its lower melting temperature (660 °C), as well as challenging task of die casting copper at its high melting temperature (1083 °C)]. Die casting copper poses problems such as shorter die life resulting from higher melting temperature of copper. After considerable research and technology development efforts, the International Copper Association (ICA) has developed a technology for manufacture of cast Copper Motor Rotors called CMR Technology. There is a need to transfer, adapt, and improve this technology to suit developing countries like India, as a means to reduce the manufacturing cost of EFF1 motors. However, at present there is a lack of skilled and trained manpower available in India in this field. At the same time, technology transfer cost for a single user would make the technology uneconomical and costly.

### 1.3 Project Strategy:

The project envisages adoption of high pressure copper die casting technology (also known as CMR Technology), most suitable for manufacture of rotors of high efficiency motors. This technology will be transferred mainly to manufacturers of rotors, motors pumps and motor systems (including small and medium scale manufacturers) in India to achieve a quantum jump in efficiency levels of motors of almost up to 5%. Cast copper rotor technology would contribute to cost-effective manufacture of high efficiency motors. To coordinate all the technology assimilation and transfer activities, the project envisages establishing an "Enabling Technology Centre" (ETC). This Centre would primarily conduct copper die-casting trials to demonstrate efficacy of the process to interested manufacturers, produce pilot production quantities of copper rotors and instruct motor manufacturers how to re-design motors to best take advantage of the substantial total motor cost reductions made possible by the incorporation of these copper rotors. Successful commercialization of the CMR Technology would be driven by cost effective manufacture of copper die-cast rotors and motors utilizing such parts. Energy efficient motors with copper die-cast rotors would result in better performance (lower operating temperature, increased insulation life and hence better reliability). The incremental efficiency gain would lead to saving electricity consumption in almost all the sectors of end use. The main environmental benefit would be reduction in CO<sub>2</sub> and other emissions associated with the energy savings achieved in end use in India (ultimately almost 40 TWh/year).

This ECT would also serve as CMR Technology demonstration centre. Over the next decade, the project would greatly facilitate introduction of ambitious minimum energy performance standards for motor drives as planned by the national authorities through the Bureau of Energy Efficiency.

2. ANNUAL WORK PLAN AND BUDGET SHEET (1st Year)

Year: 2008 (August to December 2008)

EXPECTED OUTPUTS and indicators including annual targets	PLANNED ACTIVITIES	TIMEFRAME				RESPON SIBLE PARTY	PLANNED BUDGET		
		Q1	Q2	Q3	Q4		Source of Funds	Budget Description	Amount USD
<p><b>Outcome 1:</b> Enabling Technology Centre has been set up and is fully functional.</p> <p><u>Baselining:</u> No ETC.</p> <p><u>Indicators:</u> ETC is built and functioning. Physical installation of P&amp;E.</p> <p><u>Target:</u> Physical commencement of operations of the proposed ETC.</p> <p><u>Related CP Outcome:</u> Progress towards meeting the National commitment under multilateral environmental agreements.</p>	<p>Infrastructure is ready for ETC.:</p> <p>Services for installation and commissioning of the presses.</p> <p>Travel to equipment suppliers for inspection and technical discussions.</p>			X		ICPCI NFTDC	UNDP-GEF 72100	20,000	
<p><b>Outcome 2:</b> CMR technology has been assimilated and upgraded.</p> <p><u>Baseline:</u> Aluminium die casting is used today.</p> <p><u>Indicators:</u></p>	<p>Copper die casting process is established for at least two types:</p> <p>Trials conducted for process establishment - material requirement</p>			X	X	ICPCI NFTDC	UNDP-GEF 71600	500	
						NFTDC	UNDP-GEF 72500	5,000	

<p>Successful results on pilot batches (at least 2 rotor sizes). Alliance with at least two manufacturers. <u>Target:</u> Successful trials on two rotor sizes/models to generate at least 5 enquiries from manufacturers. <u>Related CP Outcome:</u> Progress towards meeting the National commitment under multilateral environmental agreements.</p>	<p>Motor design capabilities are built:  Technical consultancy to establish contacts with motor manufacturers.  Advertise ETC facility in tech journals.</p>		X	ICPCI	UNDP-GEF	71200 71600	25,000 4,500
			X	ICPCI NFTDC	UNDP-GEF	71300	35,000
Monitoring & Evaluation	Travel		X	ICPCI	UNDP-GEF	71600	5,000
<b>TOTAL</b>	Evaluation and capacity development		X	UNDP	UNDP-GEF	71600	4,500 500
							<b>100,000</b>

### **3. MANAGEMENT ARRANGEMENTS:**

#### **3.1 Implementation Arrangements – Institutional Mechanisms & Monitoring:**

##### **3.1.1 Programme Management Board (PMB):**

PMB for the Energy & Environment Programme Outcome (Outcome 1.1 in CPD/CPAP) will be set up and co-chaired by DEA and UNDP. The PMB will oversee the delivery and achievement of results for all the initiatives under the Energy & Environment Programme Outcome and provide strategic direction for future programmes in this Outcome area. The PMB will also appraise the new programme initiatives prior to sign off with the Implementing Partners (IPs). The PMB will comprise ministries relevant to the Programme Outcome and relevant stakeholders identified in consultation with UNDP and IPs. It will meet twice a year, in the 2<sup>nd</sup> and 4<sup>th</sup> quarter, to take stock of the physical and financial progress.

##### **3.1.2 The Implementing Partner:**

The project will be nationally implemented by the Bureau of Energy Efficiency (BEE). The BEE will designate a National Project Director, who will be responsible for overall management, including achievement of planned results, and for the use of UNDP funds through effective process management and well established project review and oversight mechanisms. S/he will be assisted by a Project Manager for the day-to-day management of the project.

The Implementing Partner will also sign a budgeted Annual Work Plan with UNDP on an annual basis, as per UNDP rules and regulations.

##### **3.1.3 Project Steering Committee:**

The PSC will include representatives from the Common Fund for Commodities, UNDP-GEF, NFTDC, ICA, International Copper Study Group (ICSG – an intergovernmental organization and project supervisory commodity body), and a nominee of BEE (ex officio – Director General, BEE) and will be chaired by the NPD.

The Project Manager will provide overall direction to the project. As head of the PMU, s/he will coordinate the project in close coordination with the team located at NFTDC. This local team will be lead by NFTDC supported by a technical and a support team. NFTDC and the Project Manager would constantly liaise with the Director of Technology of ICA for inputs and technical guidance.

The PSC will carry out the following functions:



- Ensure that the project goals and objectives are achieved in a defined timeframe;
- Review the project progress and suggest implementation strategies periodically;
- Review the project expenditures against activities and outcomes; and
- Approve Annual and Quarterly Work Plans.

The PSC will be the group responsible for making, by consensus, management decisions for the project and holding periodic reviews. In order to ensure UNDP's ultimate accountability, final decision making rests with UNDP in accordance with its applicable regulations, rules, policies and procedures. Project review will be carried out with regular periodicity established by the PSC during the running of a project, or as necessary when raised by the Project Manager.

#### **3.1.4 Responsible Party:**

##### **a) International Copper Promotion Council (India) (ICPCI):**

ICPCI is the Indian Chapter of ICA. They will work in conjunction with BEE. ICPCI is the extended arm of BEE to implement the Government of India policies relating to the Copper sector. On behalf of BEE, the ICPCI will provide day-to-day implementation support in achievement of the overall project objectives in accordance with the policies of the Government of India. ICPCI will work in close cooperation with BEE and will have direct linkages to other initiatives of BEE.

ICPCI would set up a Project Management Unit and all project activities will be carried out from the PMU which will be headed by a Project Manager. The PMU will also coordinate the project activities including the preparation of Annual and Quarterly Work Plans, Budget, Financial Reports, etc. and will interface on project management issues.

#### **3.1.5 National Project Director:**

The NPD will coordinate project implementation on behalf of BEE and ensure its proper implementation.

#### **3.1.6 Project Manager:**

A Project Manager will be designated by BEE and the PSC for the day-to-day management and decision making of the project and will be accountable to the NPD and PSC. S/he will prepare the detailed activity and monitoring plan based on the Annual Work Plan (AWP) and Budget and submit it to the PSC for approval. The Project Manager will ensure that the project produces the results specified in the project document, to the required standards of quality and within the specified constraints of time and cost. The Project Manager will prepare and submit to UNDP the following reports/ documents:

Annual and Quarterly Work Plans, Quarterly and Annual Progress Reports (substantive and financial), Issue Log, Risk Log, Quality Log, Lessons Learnt Log, Communications and Monitoring Plan using standard reporting format to be provided by UNDP.

The Project Manager will head the PMU and will work in close collaboration with BEE and Responsible Party and other partner organizations and undertake periodic monitoring and review of the project activities.

### **3.1.7 Project Management Unit (PMU):**

The PMU would comprise of technical and support team. The Project Manager and the technical team would work in close coordination for project implementation. PMU would be responsible for implementation of the whole project and for achieving the project goals successfully. PMU would have technical and market development skills. In addition, ICA and ICPCI would provide need based support on the market development aspects. The technical team would have specialists to support the project.

In order to accord proper acknowledgement to GEF for providing funding, a GEF logo should appear on all relevant GEF-supported project publications, including among others, project hardware, if any, purchased with GEF funds. Any citation on publications regarding projects funded by GEF should also accord proper acknowledgement to GEF. The UNDP logo should be prominent – and separated from the GEF logo.

### **3.1.8 Project Assurance:**

Project Assurance will be the responsibility of UNDP. The Project Assurance role will support the PSC by carrying out objective and independent project oversight and monitoring functions. This role ensures that the appropriate project management milestones are managed and completed.

### **3.2 Funds Flow Arrangements and Financial Management:**

Based on the AWP, quarterly work plan will be provided by the Project Manager and funds will be released. The Responsible Party will account for funds received from UNDP on a quarterly basis through the standard Fund Authorization and Certificate of Expenditures (FACE) Report. The funds will be released to the Responsible Party (ICPCI) at the signed request and approval of the NPD, also through the standard FACE format. The Project Manager will be responsible for compilation and collation of these Financial Reports. Unspent funds from the approved AWP's will be reviewed in the early part of the last quarter of the calendar year and funds reallocated accordingly. The detailed UNDP financial guidelines will be provided on signature of the project.

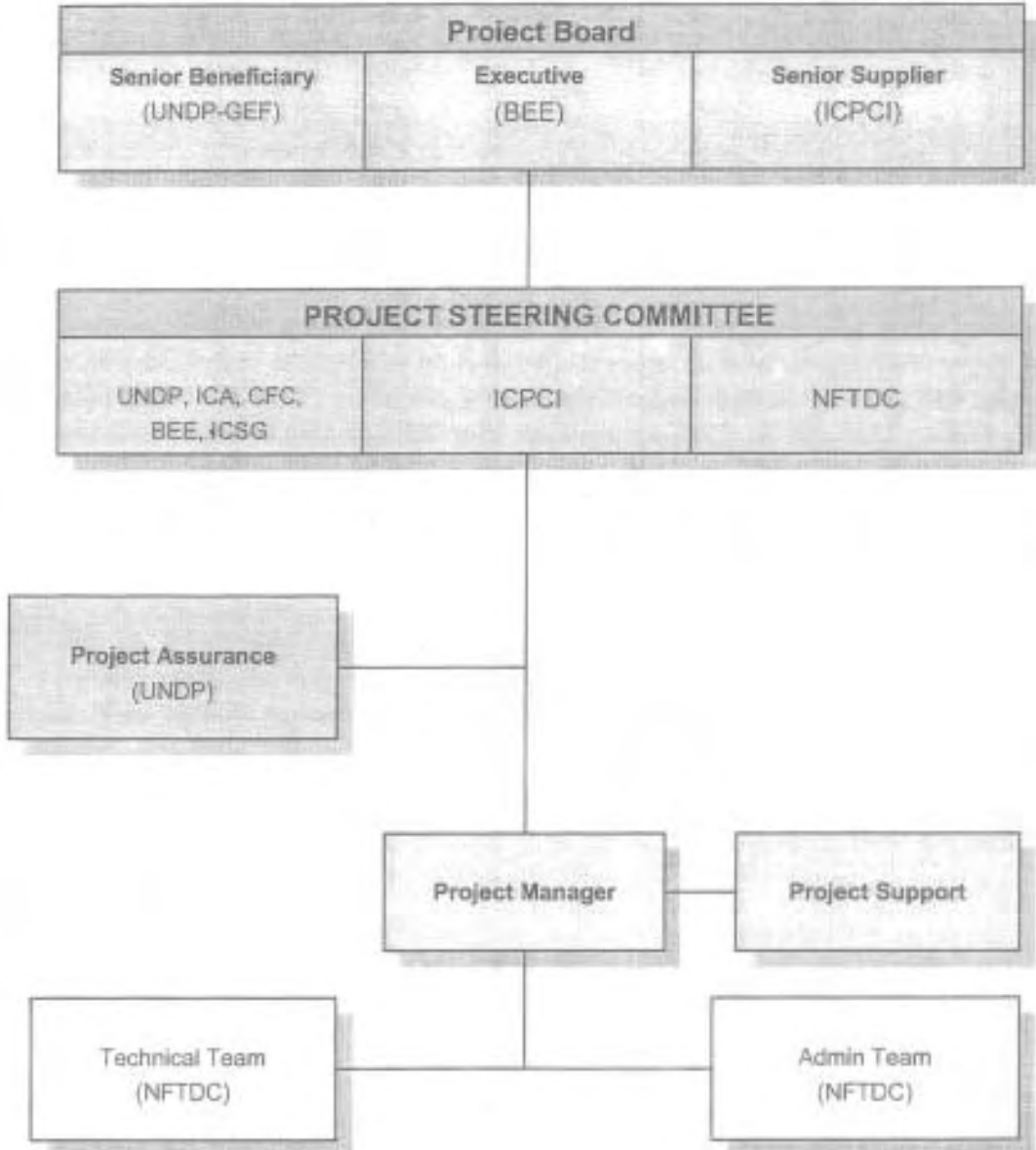
**Interest Clause:** A separate Savings Bank Account will be opened in the name of the project and any interest accrued on the project money during the project cycle will be

ploughed back into the project or refunded to UNDP if there is no scope for ploughing back.

### **3.3 Audit:**

The project shall be subject to audit in accordance with UNDP procedures and as per the annual audit plan drawn up in consultation with DEA. The project shall be informed of the audit requirements by January of the following year. The audit covering annual calendar year expenditure will focus on the following parameters – (a) financial accounting, documenting and reporting; (b) monitoring, valuation and reporting; (c) use and control of non-extendable reporting; (d) UNDP Country Office support. In line with the UN Audit Board requirements for submitting the final audit reports by 30 April, the auditors will carry out field visits during February/March. Detailed instructions on audit will be circulated by UNDP separately and on signature.

**Project Organisation Structure**



#### 4. MONITORING FRAMEWORK AND EVALUATION:

Project monitoring and evaluation will be conducted in accordance with established UNDP and GEF procedures. The details of Monitoring and Evaluation Plan have been enumerated in the attached GEF-approved proposal. This Plan will be presented and finalized at the Project's Inception Workshop following a collective fine-tuning of indicators, means of verification, and the full definition of project staff M&E responsibilities.

The project will be monitored through the following:

An M&E system within the overall results framework outlined in the project document will be established. The Project Management Team should use a variety of formal and informal monitoring tools and mechanisms. This would include field visits as well as reports such as progress reports, annual reports and annual reviews in standard UNDP formats and as per UNDP's web-based project management system (ATLAS). Within the annual cycle, the Project Manager in consultation with the NPD and UNDP will ensure the following:

##### Quarterly Basis:

1. On a quarterly basis, a quality assessment shall record progress as per established quality criteria and methods towards the completion of key results. It should also capture feedback from the beneficiary perspective as well as information related to timeliness and resources usage.
2. An Issue Log shall be activated in Atlas and updated by the Project Manager to facilitate tracking and resolution of potential problems or requests for change.
3. Based on the initial risk analysis, a risk log shall be activated in Atlas and regularly updated by reviewing the external environment that may affect the project implementation.
4. Based on the above information recorded in Atlas, a Project Progress Report (PPR) shall be submitted by the Project Manager to the PSC through Project Assurance, using the standard UNDP report format.
5. A project Lessons-learned log will be activated and regularly updated to ensure on-going learning and adaptation within the Implementing Partner, and to facilitate the preparation of the Lessons-learned Report at the end of the project.

6. A Monitoring Schedule Plan shall be activated in Atlas and updated to track key management actions/events.

Annual Basis:

1. Annual Review Report: As per UNDP requirement, an Annual Review Report will be prepared by the Project Manager and shared with the PSC and the Project Board. As minimum requirement, the Annual Review Report shall consist of the Atlas standard format for the PPR covering the whole year with updated information for each above element of the PPR as well as a summary of results achieved against pre-defined annual targets at the output level.
2. Annual Project Report (APR)/Project Implementation Review (PIR): The APR/PIR is an annual monitoring process mandated by the GEF. It has become an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project has been under implementation for a year, a Project Implementation Report must be completed. The PIR can be prepared any time during the year (July-June) and ideally prior to the Annual Project Review. The PIR should then be discussed in the Annual Review so that the result would be a PIR that has been agreed upon by the project, the executing agency, and the UNDP CO.
3. Annual Project Review: Based on the above reports, an annual project review with Implementing Partner and Responsible Party will be conducted during the fourth quarter of the year or soon after, to assess the performance of the project and appraise the Annual Work Plan (AWP) for the following year. In the last year, this review will be a final assessment. This review is driven by the PSC and may involve other stakeholders as required. It will focus on the extent to which progress is being made towards outputs, and that these remain aligned to appropriate outcomes.
4. Field visits: A representative from the UNDP office will visit each project periodically. Field visits serve the purpose of results validation, especially when undertaken in the first half of the year. If undertaken in the latter part of the year, the field visit should provide latest information on progress for annual reporting preparation. Field visits will be documented through brief and action-oriented reports, submitted within the week of return to the office.

In addition, a mid-term and a terminal evaluation of the project will be commissioned based on approval of the PSC. It will be conducted by external agencies/experts.

US \$45,000 have been set aside for Monitoring and Evaluation, out of which GEF will contribute US \$25,000 which mainly will be used to contract independent evaluators for the mid-term and final evaluations.

A detailed Communication and Advocacy Plan will be prepared that describes which activities and outputs will be monitored, reviewed and evaluated, how and by whom. A detailed Communication and Advocacy Plan needs to be drawn out by ICPCI and approved by the PSC. The Plan will articulate the types of communication and associated scheduling required during the project, as well as methods of communicating project results to stakeholders shall be activated in Atlas and updated to track key management actions/events.

Up to 1% of the total project budget will be allocated for communication and advocacy activities undertaken by UNDP.

Cost recovery for implementation support services by UNDP will be charged as per UNDP rules and regulations. The details of UNDP's support services will be outlined while finalizing the annual work plan and budget for each year.

## **5. LEGAL CONTEXT:**

This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together the instrument envisaged in the Supplemental Provisions to the Project Document, attached hereto (Annex 1).

Consistent with the above Supplemental Provisions, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

The implementing partner shall:

- a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
- b) assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.





To: Ms. Monique Barbut  
CEO, Global Environment Facility

F. No. 4(1)/15/2008 - IC &SD.1  
Dated: 19<sup>th</sup> September 2008

भारत सरकार  
पर्यावरण एवं वन मंत्रालय  
GOVERNMENT OF INDIA  
MINISTRY OF ENVIRONMENT & FORESTS

Re: Endorsement Letter for 'Transfer of Technology for High Pressure Copper Die Casting in India'

On behalf of the Government of India, and in my capacity as GEF Operational Focal Point, I hereby re-endorse the project titled 'Transfer of Technology for High Pressure Copper Die Casting in India' to be proposed through the United Nations Development Program (UNDP) to the Global Environment Facility (GEF) for funding under GEF 4.

The Government of India confirms that the project addresses national climate change priorities, and we hereby agree to allocate USD 1.0 million of the GEF climate change funds available to India through the GEF Resource Allocation Framework to this project.

Yours sincerely,

(SUDHIR MITAL)  
Joint Secretary  
and, GEF Operational Focal Point India  
Ministry of Environment and Forests  
Government of India

Cc: Mr. Rajeev P Singh, Director, DEA, North Block, New Delhi  
Dr. Madine Olson, Resident Representative, UNDP Co, 55 Lodhi Estates,  
New Delhi  
Mr. Marcel Ajers, Climate Change Manager, UNDP/GEF, New York



पर्यावरण एवं वन मंत्रालय

पर्यावरण एवं वन मंत्रालय, नोर्दर्न ब्लॉक, नई दिल्ली - 110 003



Standard Text: Supplemental Provisions to the Project Document: The Legal Context

General responsibilities of the Government, UNDP and the executing agency

1. All phases and aspects of UNDP assistance to this project shall be governed by and carried out in accordance with the relevant and applicable resolutions and decisions of the competent United Nations organs and in accordance with UNDP's policies and procedures for such projects, and subject to the requirements of the UNDP Monitoring, Evaluation and Reporting System.
2. The Government shall remain responsible for this UNDP-assisted development project and the realization of its objectives as described in this Project Document.
3. Assistance under this Project Document being provided for the benefit of the Government and the people of (the particular country or territory), the Government shall bear all risks of operations in respect of this project.
4. The Government shall provide to the project the national counterpart personnel, training facilities, land, buildings, equipment and other required services and facilities. It shall designate the Government Co-operating Agency named in the cover page of this document (hereinafter referred to as the "Co-operating Agency"), which shall be directly responsible for the implementation of the Government contribution to the project.
5. The UNDP undertakes to complement and supplement the Government participation and will provide through the Executing Agency the required expert services, training, equipment and other services within the funds available to the project.
6. Upon commencement of the project the Executing Agency shall assume primary responsibility for project execution and shall have the status of an independent contractor for this purpose. However, that primary responsibility shall be exercised in consultation with UNDP and in agreement with the Co-operating Agency. Arrangements to this effect shall be stipulated in the Project Document as well as for the transfer of this responsibility to the Government or to an entity designated by the Government during the execution of the project.
7. Part of the Government's participation may take the form of a cash contribution to UNDP. In such cases, the Executing Agency will provide the related services and facilities and will account annually to the UNDP and to the Government for the expenditure incurred.

(a) Participation of the Government

1. The Government shall provide to the project the services, equipment and facilities in the quantities and at the time specified in the Project Document. Budgetary provision, either in kind or in cash, for the Government's participation so specified shall be set forth in the Project Budgets.
2. The Co-operating Agency shall, as appropriate and in consultation with the Executing Agency, assign a director for the project on a full-time basis. He shall carry out such responsibilities in the project as are assigned to him by the Co-operating Agency.
3. The estimated cost of items included in the Government contribution, as detailed in the Project Budget, shall be based on the best information available at the time of drafting the project proposal. It is understood that price fluctuations during the period of execution of the project may necessitate an adjustment of said contribution in monetary terms; the latter shall at all times be

determined by the value of the services, equipment and facilities required for the proper execution of the project.

4. Within the given number of man-months of personnel services described in the Project Document, minor adjustments of individual assignments of project personnel provided by the Government may be made by the Government in consultation with the Executing Agency, if this is found to be in the best interest of the project. UNDP shall be so informed in all instances where such minor adjustments involve financial implications.

5. The Government shall continue to pay the local salaries and appropriate allowances of national counterpart personnel during the period of their absence from the project while on UNDP fellowships.

6. The Government shall defray any customs duties and other charges related to the clearance of project equipment, its transportation, handling, storage and related expenses within the country. It shall be responsible for its installation and maintenance, insurance, and replacement, if necessary, after delivery to the project site.

7. The Government shall make available to the project - subject to existing security provisions - any published and unpublished reports, maps, records and other data which are considered necessary to the implementation of the project.

8. Patent rights, copyright rights and other similar rights to any discoveries or work resulting from UNDP assistance in respect of this project shall belong to the UNDP. Unless otherwise agreed by the Parties in each case, however, the Government shall have the right to use any such discoveries or work within the country free of royalty and any charge of similar nature.

9. The Government shall assist all project personnel in finding suitable housing accommodation at reasonable rents.

10. The services and facilities specified in the Project Document which are to be provided to the project by the Government by means of a contribution in cash shall be set forth in the Project Budget. Payment of this amount shall be made to the UNDP in accordance with the Schedule of Payments by the Government.

11. Payment of the above-mentioned contribution to the UNDP on or before the dates specified in the Schedule of Payments by the Government is a prerequisite to commencement or continuation of project operations.

(b) Participation of the UNDP and the executing agency

1. The UNDP shall provide to the project through the Executing Agency the services, equipment and facilities described in the Project Document. Budgetary provision for the UNDP contribution as specified shall be set forth in the Project Budget.

2. The Executing Agency shall consult with the Government and UNDP on the candidature of the Project Manager a/ who, under the direction of the Executing Agency, will be responsible in the country for the Executing Agency's participation in the project. The Project Manager shall supervise the experts and other agency personnel assigned to the project, and the on-the-job training of national counterpart personnel. He shall be responsible for the management and efficient utilization of all UNDP-financed inputs, including equipment provided to the project.

3. The Executing Agency, in consultation with the Government and UNDP, shall assign international staff and other personnel to the project as specified in the Project Document, select candidates for fellowships and determine standards for the training of national counterpart personnel.

4. Fellowships shall be administered in accordance with the fellowships regulations of the Executing Agency.

a/ May also be designated Project Co-ordinator or Chief Technical Adviser, as appropriate.

5. The Executing Agency may, in agreement with the Government and UNDP, execute part or all of the project by subcontract. The selection of subcontractors shall be made, after consultation with the Government and UNDP, in accordance with the Executing Agency's procedures.

6. All material, equipment and supplies which are purchased from UNDP resources will be used exclusively for the execution of the project, and will remain the property of the UNDP in whose name it will be held by the Executing Agency. Equipment supplied by the UNDP shall be marked with the insignia of the UNDP and of the Executing Agency.

7. Arrangements may be made, if necessary, for a temporary transfer of custody of equipment to local authorities during the life of the project, without prejudice to the final transfer.

8. Prior to completion of UNDP assistance to the project, the Government, the UNDP and the Executing Agency shall consult as to the disposition of all project equipment provided by the UNDP. Title to such equipment shall normally be transferred to the Government, or to an entity nominated by the Government, when it is required for continued operation of the project or for activities following directly therefrom. The UNDP may, however, at its discretion, retain title to part or all of such equipment.

9. At an agreed time after the completion of UNDP assistance to the project, the Government and the UNDP, and if necessary the Executing Agency, shall review the activities continuing from or consequent upon the project with a view to evaluating its results.

10. UNDP may release information relating to any investment oriented project to potential investors, unless and until the Government has requested the UNDP in writing to restrict the release of information relating to such project.

#### Rights, Facilities, Privileges and Immunities

1. In accordance with the Agreement concluded by the United Nations (UNDP) and the Government concerning the provision of assistance by UNDP, the personnel of UNDP and other United Nations organizations associated with the project shall be accorded rights, facilities, privileges and immunities specified in said Agreement.

2. The Government shall grant UN volunteers, if such services are requested by the Government, the same rights, facilities, privileges and immunities as are granted to the personnel of UNDP.

3. The Executing Agency's contractors and their personnel (except nationals of the host country employed locally) shall:

(a) Be immune from legal process in respect of all acts performed by them in their official capacity in the execution of the project;

(b) Be immune from national service obligations;

(c) Be immune together with their spouses and relatives dependent on them from immigration restrictions;

(d) Be accorded the privileges of bringing into the country reasonable amounts of foreign currency for the purposes of the project or for personal use of such personnel, and of withdrawing any such amounts brought into the country, or in accordance with the relevant foreign exchange regulations, such amounts as may be earned therein by such personnel in the execution of the project;

(e) Be accorded together with their spouses and relatives dependent on them the same repatriation facilities in the event of international crisis as diplomatic envoys.

4. All personnel of the Executing Agency's contractors shall enjoy inviolability for all papers and documents relating to the project.

5. The Government shall either exempt from or bear the cost of any taxes, duties, fees or levies which it may impose on any firm or organization which may be retained by the Executing Agency and on the personnel of any such firm or organization, except for nationals of the host country employed locally, in respect of:

- (a) The salaries or wages earned by such personnel in the execution of the project;
- (b) Any equipment, materials and supplies brought into the country for the purposes of the project or which, after having been brought into the country, may be subsequently withdrawn therefrom;
- (c) Any substantial quantities of equipment, materials and supplies obtained locally for the execution of the project, such as, for example, petrol and spare parts for the operation and maintenance of equipment mentioned under (b), above, with the provision that the types and approximate quantities to be exempted and relevant procedures to be followed shall be agreed upon with the Government and, as appropriate, recorded in the Project Document; and
- (d) As in the case of concessions currently granted to UNDP and Executing Agency's personnel, any property brought, including one privately owned automobile per employee, by the firm or organization or its personnel for their personal use or consumption or which after having been brought into the country, may subsequently be withdrawn therefrom upon departure of such personnel.

6. The Government shall ensure:

- (a) prompt clearance of experts and other persons performing services in respect of this project; and
- (b) the prompt release from customs of:
  - (i) equipment, materials and supplies required in connection with this project; and
  - (ii) property belonging to and intended for the personal use or consumption of the personnel of the UNDP, its Executing Agencies, or other persons performing services on their behalf in respect of this project, except for locally recruited personnel.

7. The privileges and immunities referred to in the paragraphs above, to which such firm or organization and its personnel may be entitled, may be waived by the Executing Agency where, in its opinion or in the opinion of the UNDP, the immunity would impede the course of justice and can be waived without prejudice to the successful completion of the project or to the interest of the UNDP or the Executing Agency.

8. The Executing Agency shall provide the Government through the resident representative with the list of personnel to whom the privileges and immunities enumerated above shall apply.

9. Nothing in this Project Document or Annex shall be construed to limit the rights, facilities, privileges or immunities conferred in any other instrument upon any person, natural or juridical, referred to hereunder.

#### Suspension or termination of assistance

1. The UNDP may by written notice to the Government and to the Executing Agency concerned suspend its assistance to any project if in the judgement of the UNDP any circumstance arises which interferes with or threatens to interfere with the successful completion of the project or the accomplishment of its purposes. The UNDP may, in the same or a subsequent written notice, indicate the conditions under which it is prepared to resume its assistance to the project. Any such suspension shall continue until such time as such conditions are accepted by the Government and as the UNDP shall give written notice to the Government and the Executing Agency that it is prepared to resume its assistance.

2. If any situation referred to in paragraph 1, above, shall continue for a period of fourteen days after notice thereof and of suspension shall have been given by the UNDP to the Government and the Executing Agency, then at any time thereafter during the continuance thereof, the UNDP may by written notice to the Government and the Executing Agency terminate the project.

3. The provisions of this paragraph shall be without prejudice to any other rights or remedies the UNDP may have in the circumstances, whether under general principles of law or otherwise.

## Total Budget and Work Plan

Award ID:	00047661
Award Title:	PIMS 3489 India Achieving Reduction in GHG Emissions through Advanced Energy Efficiency Technology in Electric Motors
Business Unit:	IND10
Project ID:	00057449
Project Title:	PIMS 3489 India Achieving Reduction in GHG Emissions through Advanced Energy Efficiency Technology in Electric Motors
Responsible Party:	International Copper Promotion Council India (ICPCI)

GEF Outcome/Atlas Activity	Responsible Party	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Total (USD)
<b>OUTCOME 1:</b> Enabling Technology Centre has been set up and is fully functioning	International Copper Promotion Council India	62000	GEF	71200	International Consultants	0	3,400	2,100	5,500
				71300	Local Consultants	0	2,000	1,000	3,000
				72105	Service Contract	20,000	0	0	20,000
				71600	Travel	500	500	500	1,500
					<b>Total Outcome 1</b>	<b>20,500</b>	<b>5,900</b>	<b>3,600</b>	<b>30,000</b>
<b>OUTCOME 2:</b> CMR Technology has been assimilated and upgraded	International Copper Promotion Council India	62000	GEF	71300	Local Consultants	18,200	18,460	19,340	56,000
				71600	Travel	3,540	0	1,860	5,400
				74500	Consultations & Industry Workshop	0	7,000	4,000	11,000
				72500	Office Supplies	0	870	330	1,200
				74500	Misc	0	1,040	360	1,400
	<b>Total Outcome 2</b>	<b>21,740</b>	<b>27,370</b>	<b>25,890</b>	<b>75,000</b>				
<b>OUTCOME 3:</b> Technology has been transferred & commercialised	International Copper Promotion Council India	62000	GEF	71200	International Consultants	25,000	200	12,800	38,000
				71300	Local Consultants	9,100	9,300	9,400	27,800
				71600	Travel	7,460	840	1,200	9,500
				74500	Consultations & Industry Workshop	5,000	5,000	5,000	15,000
				72500	Office Supplies	0	1,875	625	2,500
	<b>Total Outcome 3</b>	<b>46,560</b>	<b>18,645</b>	<b>29,795</b>	<b>95,000</b>				



<b>OUTCOME 4:</b> Monitoring and Evaluation	UNDP	62000	GEF	71200	International Consultants		10,000	10,000	20,000
				71300	Local Consultants				
				71600	Travel	3,000	1,000	1,000	5,000
				74500	Consultations & Industry Workshop				
				72500	Office Supplies				
				74500	Misc				
					<b>Total Outcome 4</b>	<b>3,000</b>	<b>11,000</b>	<b>11,000</b>	<b>25,000</b>
				71300	Local Consultants	7,700	6,650	5,150	19,500
				74500	Misc	0	500	0	500
				74500	Communication & Advocacy		1,000	1,500	2,500
74500	Evaluation and capacity building	500	1,000	1,000	2,500				
	<b>Total Management</b>	<b>8,200</b>	<b>9,150</b>	<b>7,650</b>	<b>25,000</b>				
	<b>PROJECT TOTAL</b>	<b>100,000</b>	<b>72,065</b>	<b>77,935</b>	<b>250,000</b>				

**REQUEST FOR CEO ENDORSEMENT/APPROVAL**

PROJECT TYPE: Medium-sized Project

THE GEF TRUST FUND



GEF

Submission Date: 29 March 2006

Re-submission Date: 19 December  
2007

Re-Re-submission Date: 7 March 2008

Expected Calendar	
Milestones	Dates
Work Program (for FSP)	(actual)
GEF Agency Approval	April 2008
Implementation Start	May 2008
Mid-term Review (if planned)	Nov 2009
Implementation Completion	April 2011

**PART I: PROJECT INFORMATION**

GEFSEC PROJECT ID: 3152

GEF AGENCY PROJECT ID: 3489

COUNTRY(IES): India

PROJECT TITLE: Achieving Reduction in GHG Emissions Through Advanced Energy  
Efficiency Technology in Electric Motors

GEF AGENCY(IES): UNDP

OTHER EXECUTING PARTNER(S): International Copper Association (ICA)

GEF FOCAL AREA(S): Climate Change

GEF-4 STRATEGIC PROGRAM(S): SP-2

NAME OF PARENT PROGRAM/UMBRELLA PROJECT: N/A

## ACRONYMS USED

Sr. No.	Abbreviation	Expansion / Stands for
	BEE	Bureau of Energy Efficiency
	BIS	Bureau of Indian Standards
	CFC	Common Fund for Commodities
	CMR	Copper Motor Rotor
	EE	Energy Efficiency
	EFF1	Efficiency 1 under BIS Standard for energy efficient Motors
	ERDA	Electrical Research and Development Association, Vadodara, Gujarat
	ETC	Enabling Technology Centre
	GEF	Global Environment Facility
	ICA	International Copper Association, Ltd.
	ICPCI	International Copper Promotion Council (India) Limited
	ICSG	International Copper Study Group
	NFTDC	Non-Ferrous Materials Technology Development Centre
	S&L	Standards and Labeling
	UNFCC	United Nations Framework Convention on Climate Change



## PART I - PROJECT

### 2. Project Summary

#### a) PROJECT RATIONALE, OBJECTIVES, OUTCOMES/OUTPUTS, AND ACTIVITIES

India faces chronic electricity shortage (of about 10%) and up to 20% during peak periods. At the same time, the actual per capita consumption has grown from 140 kWh in 1980 to 500 kWh in 2003 and expected to grow to around 800 kWh by 2012. Of the total electricity consumption in India, motors consume almost 35%. Motors are used mainly in industrial and agricultural sectors. Most of the energy is consumed by low-voltage motors of up to 37.5 kW size which offer maximum potential for energy savings. One of the ways to address the problem of energy shortage is to reduce demand mainly by increasing end use efficiency.

In order to improve the market penetration of energy efficient motors, the Bureau of Energy Efficiency is developing a labelling program for motors under the Energy Conservation Act 2001. As per the Bureau of Indian Standards (BIS) product specifications IS 12615 – 2004, a energy efficient motor is defined similar to European standards and therefore, currently, only a select group of manufacturers produce energy efficient (EE) motors. To meet the high efficiency (rated Eff1) standard, manufacturers generally employ a range of improvements in materials, design & manufacturing methods and quality control that collectively reduce the motor's losses and boost its operating efficiency to the required standard. As per the manufacturers' feedback, a sale of these EFF1 motors is only approximately 2% of the total sales. The major reason identified for low sales is higher initial cost. Hence there is a need to develop technology which can reduce the initial cost of EFF1 motors.

As per the motor design experts, the initial cost of energy efficient induction motors can be reduced by using the copper die-casting technology for the rotors instead of Aluminum die-cast rotors. This will also help reduce the size of the motors for the same output and thus the active material and material cost.

While the stator windings in an induction motor are normally of copper, the rotors are invariably made of die-cast aluminum [ease of die casting aluminum due its lower melting temperature (660 °C), as well as challenging task of die casting copper at its high melting temperature (1083 °C)]. Die casting copper poses problems such as shorter die life resulting from higher melting temperature of copper. After considerable research and technology development efforts, the International Copper Association (ICA) has developed a technology for manufacture of cast Copper Motor Rotors called CMR Technology. There is a need to transfer, adapt, and improve this technology to suit developing countries like India, as a means to reduce the manufacturing cost of EFF1 motors. However, at present there is a lack of skilled and trained manpower available in India in this field. At the same time, technology transfer cost for a single user would make the technology uneconomical and costly.

The proposed project envisages adoption of high pressure copper die casting technology (also known as CMR Technology), most suitable for manufacture of rotors of high efficiency motors. This technology will be transferred mainly to manufacturers of rotors, motors pumps and motor systems (including small and medium scale manufacturers) in India to achieve a quantum jump in efficiency levels of motors of almost up to 5%. Cast copper rotor technology would contribute to cost-effective manufacture of high efficiency motors. To coordinate all the technology assimilation and transfer activities, the project envisages establishing an "Enabling Technology Centre" (ETC): This centre would primarily conduct copper die-casting

trials to demonstrate efficacy of the process to interested manufacturers, produce pilot production quantities of copper rotors and instruct motor manufacturers how to re-design motors to best take advantage of the substantial total motor cost reductions made possible by the incorporation of these copper rotors. Successful commercialization of the CMR Technology would be driven by cost effective manufacture of copper die-cast rotors and motors utilizing such parts. Energy efficient motors with copper die-cast rotors would result in better performance (lower operating temperature, increased insulation life and hence better reliability). The incremental efficiency gain would lead to saving electricity consumption in almost all the sectors of end use. The main environmental benefit would be reduction in CO<sub>2</sub> and other emissions associated with the energy savings achieved in end use in India (ultimately almost 40 TWh/year).

This ECT would also serve as CMR Technology demonstration centre. Over the next decade, the project would greatly facilitate introduction of ambitious minimum energy performance standards for motor drives as planned by the national authorities through India's Bureau of Energy Efficiency.

#### **b) KEY INDICATORS, ASSUMPTIONS, AND RISKS**

The principal key success indicators of the project include:

- C. Effective optimization of process for manufacture of copper-cast rotors; and
- D. Successful commercialization and market transformation

Principal parameters to be monitored would mainly comprise of following:

- Pace of project implementation activities (such as construction of additional bay, fabrication of press, commencement of trials at ETC, (Qualitative parameters);
- Number of motor manufacturers interested in acquiring copper die casting technology and hence to introduce energy efficient motor with copper die-cast rotor;
- Number of technology demonstration seminars held with required target participants;
- Number of agreements signed for technology transfer with ETC;
- Number of training workshops held and groups of participants covered, countries covered;
- Number of manufacturers initiating projects and investments for commercializing copper-cast rotor technology.

### **3. COUNTRY OWNERSHIP**

#### **A. COUNTRY ELIGIBILITY**

India is a non-Annex-A country and is a party to United Nations Framework Convention on Climate Change (UNFCCC). India signed the UNFCCC treaty on 10<sup>th</sup> June 1992. India was the 38<sup>th</sup> country to ratify the convention on 1<sup>st</sup> November 1993. India is eligible to receive support from the Global Environment Facility (GEF).

#### **B. COUNTRY DRIVEN-NESS**

India has given high priority to the cause of climate change mitigation activities and is committed to same. This is demonstrated by being a signatory to the UNFCCC. Government of India passed Energy Conservation Act in the year 2001 and established Bureau of Energy Efficiency (BEE) soon thereafter in March 2002. Important aspects of the EC Act 2001, *inter alia*, include improvement in the energy efficiency of equipment and appliances through standards and labeling. Towards this BEE has drawn up plans to establish minimum energy performance standards for various sectors and products.

BEE has been coordinating and supporting standards and labeling (S&L) programme for electrical motors, pumps and other motor driven systems such as air conditioners and refrigerators. BEE has set up a task force to address the motor S&L area. This task force has members from Bureau of Indian Standards, Manufacturers of motors (representing all sectors – small, medium and large), engineering consultancy firms, test labs, NGOs and other organizations. ICA is represented on the task force set up by BEE and has provided inputs and advice during 2003-04 in the area of motors and pumps.

#### **4. PROGRAM AND POLICY CONFORMITY**

##### **a) PROGRAM DESIGNATION AND CONFORMITY**

The project is in line with the Strategic Objective CC-SO2, which is "To promote energy-efficient technologies and practices in industrial production and manufacturing processes" and the related Strategic Program "Promoting energy efficiency in the industrial sector".

##### **b) PROJECT DESIGN (INCLUDING LOGFRAME AND INCREMENTAL REASONING)**

India is amongst the world's largest emerging energy markets and faces a chronic 10% electricity shortage and up to 20% during peak periods. Energy use is growing at 9% to 10% per year. The actual per capita consumption has grown from 140 kWh in 1980 to 500 kWh in 2003 and expected to grow to around 800 kWh by 2012. Presently, rural areas especially face problems of non-availability and quality of power. Still 56% of Indian villages do not have access to electricity. The Indian government has made ambitious plans to increase generation capacity by 100% in 10 years and reduce transmission and distribution losses to make affordable and quality power available for all by 2012. However, track record has shown the achievement of the planned target is around 60-70% and the shortage in power is expected to continue in future years.

One of the ways to address this problem is to reduce demand mainly by increasing end use efficiency. Of the total electricity consumption in India, motors consume almost 70%. Motors find use mainly in industrial and agricultural as dominant sectors. Most of the energy is consumed by low-voltage motors of up to 37.5 kW size which offer maximum potential for energy savings. Pumps and pumping systems (components etc.) use 60% of the new motors in the OEM supply chain. Any improvement in efficiency of motor would therefore result in increased efficiency of the system at end use. Assuming a HEM motors market penetration rate of 20% after 10 years of project start the accumulated energy savings are about 429 GWh of electricity Corresponding GHG emission savings associated with the energy savings

amount to about 360,000 T(CO<sub>2</sub>).<sup>1</sup> Bureau of Energy Efficiency (BEE), Ministry of Power (MoP) and the Government of India have rightfully targeted motors and motor drives as one of its focus areas to work on.

### **Technology transfer - efficient motor technology**

Technology transfer is one of the most preferred routes for upgrading the manufacturing technology in the developing countries. This route helps acquiring better and efficient technology, which helps improving product quality leading to increase in market share, at the same time increasing potential for exports. However, this route is often less cost effective or expensive for small and medium enterprises (SMEs). On the other hand, large companies do have ongoing strategic alliances, which facilitate technology up-gradation and acquisition of new skills.

Motor technology, on the other hand, has relatively low technology activity (as compared with that in the computers and electronics technology). Technology development, in this field, has also been marginal and limited to specific areas such as increasing pole length of motors, reducing hysteresis losses. High pressure copper die casting technology for motor rotors is the most significant development in USA and Europe, which has been described at length over the passage.

### **Energy Efficient Motors - a brief overview**

All over the world, induction motors form a vast population of prime movers to drive the various systems in the industries, commercial establishments, homes and agriculture. Induction motors are simple machines to convert electrical energy to mechanical energy and are comprised of stator, rotor, winding materials and enclosure as major components.

Over the years efforts to increase energy efficiency of motors were mainly directed towards:

- Increasing length of poles of motors and hence increase in copper content in stator windings;
- Reducing hysteresis loss (cyclic energy loss in magnetic material) by
  - Developing new alternative materials (e.g. high silicon steel),
  - Reducing thickness of laminations;
  - Reducing air gap,
  - Reducing friction and other mechanical losses

Currently, only a select group of manufacturers produce energy efficient (EE) motors. To meet the high efficiency (Eff1) standard, manufacturers generally employ a range of improvements in materials, design & manufacturing methods and quality control that collectively reduce the motor's losses and boost its operating efficiency to the required standard. The improvements include high grade low loss steel cores in the stator laminations, improved insulation, greater copper content in the stator windings, improved resins and varnishing practices, better temperature control in the baking/curing process, and so on.

### **Copper Cast Motors**

<sup>1</sup> Please refer to annex 1 for more detailed calculations.

While the stator windings in an induction motor are normally of copper, the rotors are invariably made of die-cast aluminum. This was due to ease of die casting aluminum due its lower melting temperature (660 °C), as well as extremely difficult task of die casting copper at its high melting temperature (1083 °C). *Following box* provides a brief note on use of copper in rotors.

Use of copper in the rotors in a broad range of sizes of induction motors could represent a significant advance in motor technology. This is because the readily available and least expensive improvements to increase motor energy efficiency have been adopted in recent years. Motor losses have been forced down steadily over time, but with diminishing returns as additional increments come at much increased cost.

It is well known that incorporation of copper for the conductor bars and end rings of the induction motor in place of aluminum would result in attractive improvements in motor energy efficiency. Die cast motor rotors are universally produced in aluminum today because of fabrication by pressure die casting is a well-established and economical method. Only small numbers of very large motors utilize copper in the rotors by fabrication. Such fabrication involves intensive hand labor and therefore is expensive. Die casting, when it can be performed, is widely recognized as a low cost manufacturing process. For these reasons, die casting has become the fabrication method of choice and aluminum the conductor of choice in all but the largest frame motors. Tool steel moulds as used for the aluminum die casting process have proved to have limited life when casting higher melting point metals including copper. Lack of a durable and cost effective mould material has been a key technical barrier preventing manufacture of the "copper cast rotor" (CCR).

Because the electrical conductivity of copper is nearly 60% higher than that of aluminum, one would expect the  $I^2R$  losses in the rotor to be substantially lower if copper were substituted for aluminum as the conductive material of the squirrel cage structure. Motor modeling by several manufacturers has shown that motors with copper-cast rotors would have overall loss reductions of 15 to 20%. Aluminum has been the material of choice for all but very large motors because the intricate squirrel cage is readily manufactured by pressure die casting through the rotor lamination stack.





Large HT motors and a few smaller rating submersible pump/special purpose motors with copper in the rotors are assembled by a slow and costly fabrication technique that is not economical for production of the millions of integral and fractional horsepower motors sold annually. Die casting of the copper would help rapid and cost-effective manufacture, but the process has not been practical because of short die life resulting from the high melting temperature of copper.

While small and medium-scale manufactures could follow the same approach, their mode of operation poses difficulties. The wide range of improvements may require an unreasonable level of investment, and the quality control improvements may be difficult to sustain except in the best managed units. Currently, in India, around 500 SME manufacturers and over 1,000 OEMs and trade channels in motors business employ close to 30,000 semi-skilled workers. In this scenario, the development of the energy-efficient motor market share provides an opportunity for only a few, and a threat for many in the SME motor and pump cluster. However, the copper die-cast rotor may offer a solution to this situation.

At a given efficiency level, the copper rotor allows motors to be generally smaller, lighter and up to 15% less expensive. Multiple analyses have shown 15 to 20% reduction in motor losses achievable with copper rotor compared to same motor design using aluminum because the conductivity of copper is 60% higher. These reduced losses translate to a 1%-5% increase in nameplate efficiency of the motor.

CMR technology has been developed and commercialized by very large motor manufacturers in US and Europe. These companies have developed this technology on their own in their well established R&D laboratories. Technology thus developed is not available for transfer at large. Even if one motor manufacturer opts for technology transfer by paying the high fees, such a transfer fee would make the ultimate product uneconomic. The purpose of developing the technology is to transfer all interested motor manufacturers in India and other neighboring South Asia Countries.

### **Institutional, sectoral and policy context**

Government of India enacted the Energy Conservation Act, 2001 keeping in view of importance and benefits of energy efficiency. The Schedule to the Energy Conservation Act provides a list of energy Intensive Industries and other establishments, specified as Designated Consumer. The notified Designated Consumer has to take up certain activities mandatory under the Act, the Bureau of Energy Efficiency (BEE) has approved notification of such of the industrial units as Designated Consumers. *BEE is a statutory body* under the Ministry of Power and was formed subsequent to enactment of Energy Conservation Act 2001. The *mission of BEE* is to institutionalize energy efficiency services, enable delivery mechanisms in the country and provide leadership to the key players involved in the energy conservation movement. The primary goal of the Bureau is to reduce the energy intensity in the economy. BEE has set up variety of task forces to address major thrust areas of energy conservation. BEE has identified standards & labeling as one of the thrust areas.

Standards set by national standards agency (Bureau of Indian Standards in India) play crucial role in promotion of the efficient motors and other appliances. Toward this end BEE has been coordinating and supporting standards and labeling (S&L) programme for electrical motors, pumps and other motor driven systems such as air conditioners and refrigerators.

BEE has set up a task force to address the motor S&L area. This task force has members from Bureau of Indian Standards, manufacturers of motors (representing all sectors – small, medium and large), engineering consultancy firms, test labs, NGOs and other organizations.

### **Threats, root causes and barriers analysis**

Motor and motor drives technology cuts across almost all the sectors of energy use at the same time, it accounts for maximum electricity consumption in most of the countries. There have been several efforts to improve efficiency of electrical motors over the years. Some of these technologies have achieved limited success in terms of improving efficiency level by only 2% – 3%.

The main barrier to achieving quantum jump in efficiency of electrical induction motors has been new technology to reduce losses in rotor. One of the ways to achieve substantial reduction in losses as well as materials use is to have copper cast rotor. While the stator windings in an induction motor are normally of copper, the rotors are invariably made of die-cast aluminum. This was due to ease of die casting aluminum due its lower melting temperature (660 °C), as well as extremely difficult task of die casting copper above its high melting temperature (1083 °C).

International Copper Association, Ltd. has developed high pressure copper die casting technology which finds application in the manufacturing of cast copper rotors for use in high efficiency motors. Transfer of this technology to a single manufacturer in isolation could be a costly proposition. Besides, skills needed for high pressure copper die casting are not widely available in the country.

Thus the main barriers to commercialization of copper die casting technology are:

- Lack of availability of cost-effective technology and
- Lack of appropriate skills

Market barriers to increasing share of energy efficient motors (in general) include:

- Unwillingness of end users to pay higher price for efficient motors
- Lack of understanding/ awareness about life cycle costing approach to procurement
- Institutional and tariff barriers

### **Need for skills development and technology transfer**

ICA, with additional support from US government and motor companies, invested several million dollars to develop a technology that allows copper to be die-cast into motor rotors. Before this invention, the high melting temperature of copper made economic die casting impossible. The advantages of high conductivity copper replacing aluminum in the rotors are increased energy efficiency and lower operating temperatures, or reduced motor sizes, or lowered manufacturing costs, or a compromise solution combining all these features.

While in Europe and USA, private and government financing for project implementation, for training of skilled workers and for capital investments are available, the need exists to assist

developing countries with technology transfer and capital requirements. Secondly, energy efficient motors contribute to reductions in greenhouse gas emissions and economic development, but their higher cost can be a market barrier, especially where there are no mandated performance standards. The solution of combining higher efficiency with lowered cost should be a vital action primarily in developing countries.

### **Project Goal, Objective, Outcomes and Outputs/activities**

*Project Goal:* Reduce GHG emissions associated with the electric motor industry.

*Project Objective:* Introduce technology for high pressure copper die casting for manufacturers of copper cast rotor and electric motors to achieve energy savings.

The proposed project envisages transfer of technology for high pressure copper die casting technology most suitable for manufacture of rotors of high efficiency motors. Project envisages establishing Enabling Technology Centre (ETC) for conducting pilot die casting of rotors to be installed in high efficiency motors, thus evolving cost-effective die casting process and motor manufacturing, and for demonstration of the process to interested manufacturers. Technology would be transferred mainly to manufacturers of rotors, motors and motor systems. Successful introduction of the technology would be driven by process for cost effective manufacture of copper die-cast rotors and of the complete motors. Energy efficient motors with copper die-cast rotors would result in better performance (lower operating temperature, increased insulation life and hence better reliability).

The main components of the project are:

1. Enabling Technology Centre has been set up and is fully functioning
  2. CMR Technology has been assimilated and upgraded
  3. Technology has been Transferred & commercialized
- 
1. Enabling Technology Centre has been set up and is fully functioning: This outcome would comprise the following activities
    - a. Building an additional bay to accommodate ETC: The Non Ferrous Technology Development Centre (NFTDC) will build adequate space within its premises at Hyderabad. An additional bay would be constructed to locate specialized equipment in support of CMR technology optimization. This construction work would be completed within a short span of time (estimated time: 10 months).
    - b. Fabricated, procured and commissioned machinery and equipment at the ETC: NFTDC would fabricate a casting press, which is the key equipment required. Additional manufacturing and testing equipment would be procured to launch operations at ETC.
  2. CMR Technology has been assimilated and upgraded: Developing appropriate motor designs and processes to suit these designs in the most cost effective manner. This will comprise the following activities:
    - a. *Forming alliances with motor manufacturers to work jointly on the product/ process design:* Formation of alliances with manufacturers of motors / rotors would lead to building a successful foundation for marketing CMR Technology for its eventual transfer and hence commercialization. ICA would associate motor / rotor manufacturers as well as die casting products manufacturers to develop copper die casting process for specific target motor frames. ICA would make all the efforts to convince the partner organization the benefit of such association and likely



commercialization prospects. Partner organization (e.g. motor manufacturer) would develop new design for the copper rotor motor with experts and trial set of die casting dies. Rotors for these designs would be manufactured with copper as the conducting material at the ETC using CMR Technology.

- b. *Conducting trials and technical studies:* Trials and Technical Studies would be conducted under the technology support activities at the ETC. As a part of technology assimilation and process optimization exercises project team at ETC would conduct several trials and technical studies. Technical experts and consultants from ICA would provide important technical input to ETC team members. ETC would also closely work with some of the stakeholder organizations such as motor manufacturers and tool rooms. Die casting trials would provide leads for eventual optimization of parameters die casting process. Once the pilot batches of rotor are manufactured, the same would be tested for their performance.
  - c. *Integrating good product design and process seamlessly:* Motor design would be evolved by working with experts to suit copper die casting process.
3. Technology has been Transferred & commercialized: Increase efficacy of CMR technology to be suitable for industrial scale manufacture of CMRs; Technical studies and trials would be geared to achieve scaling up of the process to commercial production levels. Cost-benefit analysis would be undertaken to evaluate the benefits of the process developed to manufacture CMRs so as to transfer the technology to motor manufactures.
- a. Technology transfer agreements would be signed with partner organizations desirous of acquiring the technology for copper die casting. Once the efficacy of the process is demonstrated to partner organizations as also product development (rotors for specific frame sizes) specific to their needs, ETC in consultation with ICA would provide all the information, data related to commercialization including sources of procuring equipments and machinery, tools and accessories. After partner organizations are convinced of prospects of commercialization and high probability of success, they would sign technology transfer agreements with ETC. ETC would provide manuals for project implementation as well train personnel of manufacturers for developing requisite skills. CMR Technology transfer process would be complete once commercial production commences at manufacturers' premises achieving all the promised parameters.
  - b. Developed adequate market in support of commercialization of CMR technology including development of alliances with financing agencies to offer incentives / financial support to adopt technology and OEM applications development; Market development for high efficiency copper cast rotor motors would be an important phase of the project, which would form the base for commercial success of the technology. ICA in close coordination with ETC would initiate all the market development activities for creating demand for these motors. These activities would mainly include creating awareness about this technology and product among the end user groups (OEMs, end user companies and distributors). Market development efforts would go in parallel to process development and technology transfer. Early efforts would help creating market demand for such motors, after identifying specific target sectors and niche areas. Technology demonstrations for end users would also support market development. Financing schemes / arrangements to promote high efficiency copper rotor motors would help accelerating commercialization of the technology. ICA would work along with commercial banks and other financing agencies to develop dedicated financing schemes. ICA would also approach specialized agencies and institutions for specific support (e.g. technical assistance from multilateral agencies) in respect of financing mechanisms.

## Indicators

The success of the project would be mainly indicated by the quantity of high efficiency motors with copper rotor sold per year by manufacturers in India and in other Asian countries.

Some of the key project indicators are listed below:

- A. Effective optimization of process for manufacture of copper-cast rotors
- B. Successful commercialization and market transformation
- C. Construction of additional bay, successful fabrication, physical installation of plant and equipments at ETC.
- D. Commencement of trials and tests at ETC
- E. Successful manufacture of pilot batches of copper rotor motors (for at least two rotor sizes).
- F. Successful alliance formation with at least two manufacturers.
- G. Signing of technology transfer agreements with at least two manufacturers.
- H. Increased level of enquiries from end users and OEMs as a result of market development efforts initiated by ICA.
- I. Banks and financing agencies indicating interest in developing schemes to promote high efficiency copper rotor motors.

## Risks

Principal risks associated with the project fall into the following categories:

- Technology Risk
- Market Risk
- Project Implementation (operational) Risks

### Technology Risk

The principal risk associated with this project is the technology risk. Acceptance of the technology by motor manufacturers and its propagation would determine the success of the project. The following eventualities have been envisaged:

- Inadequate performance of rotors and motors due to poor implementation of the technology or low quality assurance (thereby not being able to achieve significant energy efficiency gains)
- High cost of commercial production of copper motor rotors (CMRs)
- Inadequate acceptance of CMR technology.

Copper die-cast rotor technology has been demonstrated to be successful in USA and in Europe while recent and current cost studies of motors with copper rotors prove out the substantial cost reduction opportunity NPTDC would provide performance guarantee for the equipments to be fabricated in-house. ICA, hence, is confident that the technology will have a high probability of success.

### Market Risk

Main market related risks associated with the project include:

- Changes in tariffs: Increase in import duty on copper concentrates could lead to rise in copper prices. However, Government of India is not expected to increase import duties on copper concentrates and copper products in the near term (3 years).
- Availability of better efficient motors (having high efficiency levels and better performance) with conventional technology (increased pole length, improved laminations) at relatively lower prices.

### **Project Implementation Risks**

**Project Completion Risk:** Formation of ETC requires machinery and equipments to be in place and commissioned in time after completion of construction of bay. ICA proposes to use latest project management tools and techniques to overcome these possible problems. For instance, part of the machinery could be fabricated in-house at NFTDC. Critical path activities would be monitored closely for effective control and hence to mitigating this risk.

**Operational Risk:** Operations of ETC are dependent upon several inputs and working with variety of organizations. Any delay on the part of the partner organization or inadequate performance can have effect on the operations of ETC. Effective management and leadership qualities of the ETC team manager would help to overcome these difficulties.

### **Assumptions**

India is on the path of reforms and restructuring. In the recent years, two important Acts were affected, which are Energy Conservation Act and Electricity Act 2003. ICA expects that government of India would follow this path and the policy environment would support use of energy efficient technologies. At the same time the business environment would provide sufficient opportunities for motor manufacturers to set up additional capacity to manufacture cast copper rotors.

Die casting moulds and mould inserts would be acquired locally, as there are sufficient number of well established and well equipped tool rooms in India that are manufacturing high quality tools and dies. At the same time technical experts and consultants of ICA would provide inputs and guidance to ETC team.

ICA has already received indications from leading motor manufacturers to participate in the proposed project. A number of stakeholder organizations have indicated willingness to be project partners by providing either "in-kind" contribution or "in-cash" contribution to the project.

Total input cost of the materials and labor for a motor using copper rotor would be lower as compared with motors of the same power rating using aluminum rotor. This would result into better economics and hence successful adoption and commercialization. Promotion of cost-effective technology such as cast copper rotor motors would attract financing agencies and commercial banks, as the perceived risks associated with such technologies is always lower. At the same time, successful technology demonstrations would help gaining better footing.

**Table 1: Logical Framework and Objectively Verifiable Impact Indicators**

Objectively verifiable indicators					
Project Strategy	Indicator	Baseline	Target	Sources of verification	Risks and assumptions
Goal	Reduce GHG emissions associated with the electric motor industry.				
Objective: Introduce technology for high pressure copper die casting for manufacturers of copper cast rotor and electric motors to achieve energy savings	Quantity of high efficiency copper rotor motors sold per year by manufacturers in India and from other South Asian countries. (3 years from the commencement of project)	Number of motors sold per annum in India, percentage share of conventional energy efficiency motors.	Increase market share of high efficiency copper rotor motors through technology transfer and commercialization with supporting market development activities; market penetration rate of 3% after 3 years and 20% after 10 years	Market data, information supplied by motor manufacturers (ones which acquired and commercialized the copper rotor motors technology from CoE).	<ul style="list-style-type: none"> <li>- Technology risk</li> <li>- Market risk</li> <li>- Implementation risk (Please refer note #1)</li> </ul> Assumptions: <ul style="list-style-type: none"> <li>- Policy environment encouraging energy efficiency</li> <li>- Business environment conducive to setting up additional capacity for copper rotor manufacturing</li> </ul>
Outcome 1: Enabling Technology Centre has been set up and is fully functioning	ETC is built and functioning	No ETC	Physical commencement of operations of the proposed ETC. (Within 1 year post project launch)	Periodic (quarterly) progress reports from ICA/ICPCI	Risk: Delay in construction of ETC. Assumption: Construction would be undertaken by reputed local construction firm. Hence no major risk in completion. Technology risk. Assumption: NPTDC has good track record in developing and fabricating large number of equipments including specialized furnaces for oxygen free copper. Fabricating high quality equipment will not pose any challenges.
Outcome 2: CMR Technology has been assimilated and	Successful results on pilot batches of cast copper rotors (at least two rotor sizes), (within	In the absence of the high pressure copper die casting technology	Designing and fabricating furnace and other subassemblies including die inserts for copper die casting will be the main goal under the activity. Successful fabrication will lead to cost effective commercialization of the process.	Periodic progress reports by ICA and ETC.	Technological risks Assumptions: The technology has been proven in USA and in

upgraded	Two years post project launch)  Successful alliance formed with at least two manufacturers (within two years post project launch	there is no commercial manufacture of copper cast rotors in India.  Today manufactures use aluminium die-cast rotors	generating at least 5 enquiries from manufacturers  Approximate size of manufacturing capacity expected to be installed for copper rotor manufacture.	ETC. Letters of enquiries from manufacturers.	Europe on lab level Technical experts will be providing support. Considering track record of NFTDC, there is minimum risk associated with trials.  Risk perceived by some manufacturers. Assumption: ICA has already received expressions of interest from some of the leading motor manufacturers to participate in the proposed project. There is considerable interest in technology acquisition.
<b>Outcome 3: Technology has been Transferred &amp; commercialized</b>	Arrange visits of motor manufacturers to ETC & demonstrate technical feasibility for copper die-casting  Signed technology transfer agreements (at least with two manufacturers) (Within 3 years post project launch)  At least 10 letters of enquiries from end users and OEMs (Within 3 years post project launch) as result of market development programs and awareness building exercise.  At least one Bank / financing agency launches a scheme to promote new high efficiency motors / products. (Within 3 years post project launch)	No knowledge of copper die-casting with Indian motor manufacturers  Partner organizations indicated willingness to work jointly.  At present there is no awareness about cast copper rotors  Conventional financing arrangements will serve to certain extent.	Arrange visits of manufacturers representing min 60% of the market size  Signed at least two technology transfer agreements with interested manufacturers.  Received at least 10 letters of enquiries from end used and OEMs.  Specific financing scheme with view to encouraging use of high efficiency motors with copper cast rotors by at least one bank of financing agency.	Visit Reports  Reports of technology market development workshops  Letters of enquiries received by motor manufacturers.  Actual launch of schemes by financing agencies.	Risk: Higher level of incremental investment for commercialization.  Assumption: Trials on vertical press are expected to reduce production cycle time.  Technology risk and perceived risk by manufacturers.  Assumption: Cost-benefit results would enable convincing manufacturers to sign for tech transfer  Market risks  The cost premium of the high efficiency motors perceived high.  Assumption: Total input cost of the materials (for copper rotor will be lower (as compared with aluminium rotor of same rating) resulting into better economics.  Financing risks perceived by banks and institutions.  Assumption: Cost effective efficient technology promotion with conducting efficiency supporting policies will

						encourage banks to promote better schemes.
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**c) SUSTAINABILITY (INCLUDING FINANCIAL SUSTAINABILITY)**

The proposed project envisages transfer of CMR Technology to manufacturers of motors and motor systems. Once manufacturers adopt the technology to manufacture copper rotors in high efficiency motors and thus commercialise the same, the global environment benefits will start to accrue. Manufacture and subsequent use of high efficiency copper rotor motors in variety of end use sectors will result into saving of electricity. The responsibility of successful commercialisation of the technology would be with the proposed ETC. This centre would initially receive funding support for conducting its activities. Progressively, the proposed centre is expected to generate revenue to continue its activities. The revenue model of ETC envisages providing production services to copper rotor die casting. Manufacturers would bring-in ready stacks of laminations in small batches to ETC. These assembled stacks would be processed to form copper cast rotors using specialised dies and die casting facilities at the centre. Successful commercialisation of copper die cast rotor technology would lead to accrual of global environment benefits.

**d) REPLICABILITY**

The proposed project envisaged development of skills in support of copper die casting technology. ETC would conduct several training seminars and demonstration workshops to train technicians to adopt necessary skills. These training sessions by ETC would ensure uniform manufacturing practices, leading to replicability. Activities of ETC seek active support of and close coordination with motor and motor systems manufacturers. The project activities dovetail with the existing on-going efforts in the area by other government agencies. The project is mainly driven by the transfer of technology and commercialisation efforts, which in principle are replicable easily in other parts of the world. Expansion and replication of market development efforts will focus on the Indian subcontinent.

**e) STAKEHOLDER INVOLVEMENT**

*ICA and ETC propose to work closely with all the stakeholders to achieve the goal of the project to commercialize copper rotor die casting technology and hence to reduce GHG emissions. Significant stakeholders include:*

- Manufacturers of
  - Motors including Rotors
  - Motors systems and
  - Pumps
  - Other allied products
- Associations of manufacturers of motors, pumps, chambers of associations
- Research institutions and testing laboratories
- Tool Room establishments / facilities
- End users of motors and OEMs
- Government Ministries and statutory bodies

**Motor Manufacturers:**

Motor manufacturers including Crompton Greaves, Kirloskar Electric, Siemens, Bharat Bijlee and other small and medium manufacturers would be associated with the project. Some of



these manufacturers have already indicated, through letters, their interest in working on the project closely with ICA. The main reason of involving motors and motor systems manufacturers is that these organisations would be users and beneficiaries of the copper cast rotor technology.

Motor manufacturers are one of the main beneficiaries of the proposed ETC initiative. Motor manufacturers can play one or more of the following role(s):

- Help designing new high efficiency motors to take advantage of the motor cost reduction made feasible by use of copper cast rotors.
- Provide inputs to develop procedures and set-up for testing cast copper rotor
- Contribute in evolving and developing new high efficiency standards for cast copper rotor motors
- Help developing new applications for these new types of motors.
- Preparing market development programs to convince existing end-users and OEMs to switch over to cast copper rotor motors.
- Assist in developing selection guides and user manuals for new high efficiency motors

Associations of manufacturers (e.g. IEEMA) would associate with the project primarily because its members would ultimately benefit. These associations would contribute to spreading the message of the project and its benefits.

#### Die Casting Establishments:

Present aluminum die-cast rotor manufacturers are natural stakeholders in this project. Of these manufacturers desirous of acquiring copper die casting process know how would benefit a great from this project. Die casting foundries have basic skills for aluminum / Al-alloy casting, hence need upgrade and skill development in copper die casting. These manufacturers can play one or more of the following role(s):

- Provide inputs in procuring die inserts and die casting dies
- Assist in process optimization and die casting trials and trial production
- Assist in procuring plant and equipments
- Provide personnel on deputation basis

#### Tool Rooms:

Tool room establishments (as part of large manufacturing establishment) would play significant role in providing critical inputs for die inserts design and manufacture. Tool room centres (specialized in die casting dies) have skills for designing dies and making dies and die inserts. These organizations can play one or more of the following role(s):

- Provide technical inputs while designing trial dies and die inserts
- Assistance in manufacturer of dies and die-inserts
- Analyzing samples of die cast rotors and modifications necessary in die inserts
- Identify problems in trial production, and provide feedback on modifications necessary
- Estimating costs of production for commercial production
- Provide need based personnel to attend problems

#### Test laboratories:

Test laboratories (independent as well as in house labs of manufacturers) would be able provide all testing support to the proposed ETC. These organizations can play one or more of the following role(s):

- Provide inputs to design test procedures



- Conduct trials on rotors and motors at its own laboratories
- Conduct other analysis such as metallurgical tests and chemical analysis to judge alloy contents
- Energy efficiency tests on motors using cast copper rotors

All the stakeholders would play equally important roles in the proposed project. Manufacturers of motors have already expressed desire to associate with the project. End users are the ones who would ultimately provide acceptance of the new high efficient motors and buy these motors. Their participation during the technology demonstration seminars and market development workshops would help leading project to success.

#### f) MONITORING AND EVALUATION

Project monitoring and evaluation will be conducted in accordance with established UNDP and GEF procedures and will be provided by the project team and the UNDP Country Office (UNDP-CO) with support from UNDP/GEF. The Logical Framework Matrix provides *performance and impact* indicators for project implementation along with their corresponding *means of verification*. These will form the basis on which the project's Monitoring and Evaluation system will be built.

The following sections outline the principle components of the Monitoring and Evaluation Plan and indicative cost estimates related to M&E activities. The project's Monitoring and Evaluation Plan will be presented and finalized at the Project's Inception Report following a collective fine-tuning of indicators, means of verification, and the full definition of project staff M&E responsibilities.

#### INCEPTION

A Project Inception Workshop will be conducted with the full project team, relevant government counterparts, co-financing partners, the UNDP-CO and representation from the UNDP-GEF Regional Coordinating Unit, as well as UNDP-GEF (HQs) as appropriate.

A fundamental objective of this Inception Workshop will be to assist the project team to understand and take ownership of the project's goals and objectives, as well as finalize preparation of the project's first annual work plan on the basis of the project's logframe matrix. This will include reviewing the logframe (indicators, means of verification, assumptions), imparting additional detail as needed, and on the basis of this exercise finalize the Annual Work Plan (AWP) with precise and measurable performance indicators, and in a manner consistent with the expected outcomes for the project.

#### MONITORING

Day to day monitoring of implementation progress will be the responsibility of the Project Manager based on the project's Annual Work Plan and its indicators. The Project Team will inform the UNDP-CO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

Measurement of impact indicators related to global benefits will occur according to

the schedules defined in the Inception Workshop and tentatively outlined in the indicative Impact Measurement Template at the end of this Annex. The measurement, of these will be undertaken through subcontracts or retainers with relevant institutions (e.g. vegetation cover via analysis of satellite imagery, or populations of key species through inventories) or through specific studies that are to form part of the projects activities (e.g. measurement carbon benefits from improved efficiency of ovens or through surveys for capacity building efforts) or periodic sampling such as with sedimentation.

*Periodic monitoring of implementation progress* will be undertaken by the UNDP-CO through quarterly meetings with the project proponent, or more frequently as deemed necessary. This will allow parties to take stock and to troubleshoot any problems pertaining to the project in a timely fashion to ensure smooth implementation of project activities.

UNDP Country Offices and UNDP-GEF RCUs as appropriate, will conduct yearly visits to projects that have field sites, or more often based on an agreed upon scheduled to be detailed in the project's Inception Report / Annual Work Plan to assess first hand project progress. Any other member of the Steering Committee can also accompany, as decided by the SC. A Field Visit Report will be prepared by the CO and circulated no less than one month after the visit to the project team, all SC members, and UNDP-GEF.

## REPORTING

The Project Manager in conjunction with the UNDP-GEF extended team will be responsible for the preparation and submission of the following reports that form part of the monitoring process.

### *(a) Inception Report (IR)*

A Project Inception Report will be prepared immediately following the Inception Workshop. It will include a detailed First Year/ Annual Work Plan divided in quarterly time-frames detailing the activities and progress indicators that will guide implementation during the first year of the project. This Work Plan would include the dates of specific field visits, support missions from the UNDP-CO or the Regional Coordinating Unit (RCU) or consultants, as well as time-frames for meetings of the project's decision making structures. The Report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 months time-frame.

The Inception Report will include a more detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners. In addition, a section will be included on progress to date on project establishment and start-up activities and an update of any changed external conditions that may effect project implementation.

When finalized the report will be circulated to project counterparts who will be given a period of one calendar month in which to respond with comments or queries. Prior to this circulation of the IR, the UNDP Country Office and UNDP-GEF's Regional

Coordinating Unit will review the document.

*(b) Annual Project Report (APR)/ Project Implementation Review (PIR)*

The APR/PIR is an annual monitoring process mandated by the GEF. It has become an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project has been under implementation for a year, a Project Implementation Report must be completed by the CO together with the project. The PIR can be prepared any time during the year (July-June) and ideally prior to the TPR. The PIR should then be discussed in the TPR so that the result would be a PIR that has been agreed upon by the project, the executing agency, UNDP CO and the concerned RC.

*(c) Quarterly Progress Reports*

Short reports outlining main updates in project progress will be provided quarterly to the local UNDP Country Office and the UNDP-GEF regional office by the project team.

#### **INDEPENDENT EVALUATION**

The project will be subjected to one external final evaluation. The independent Final Evaluation will take place three months prior to the terminal tripartite review meeting. The final evaluation will also look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation should also provide recommendations for follow-up activities. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

#### **AUDIT CLAUSE**

The Government will provide the Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds according to the established procedures set out in the Programming and Finance manuals. The Audit will be conducted by the legally recognized auditor of the Government, or by a commercial auditor engaged by the Government.

#### **LEARNING AND KNOWLEDGE SHARING**

Results from the project will be disseminated within and beyond the project intervention zone through a number of existing information sharing networks and forums.

The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation through lessons learned.

The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identify and analyzing lessons learned is an on-going process, and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered not less frequently than once every 12 months. UNDP/GEF shall provide a format and assist the project team in categorizing, documenting and reporting on lessons learned.

#### **M&E Budget**

USD 45,000 have been set aside for Monitoring and Evaluation. GEF will contribute USD 25,000 which mainly will be used to contract independent evaluators for the mid-term and final evaluations.

## 5. FINANCING

### FINANCING PLAN, COST EFFECTIVENESS, CO-FINANCING, CO-FINANCIERS

#### a) PROJECT COSTS

<i>Project Components/Outcomes</i>	<i>Co-financing (\$)</i>	<i>GEF (\$)</i>	<i>Total (\$)</i>
1. Enabling Technology Centre has been set up and is fully functioning	660,100	30,000	690,100
2. CMR Technology has been assimilated and upgraded	283,700	75,000	358,700
3. Technology has been Transferred & commercialized	105,200	95,000	200,200
4. Monitoring and Evaluation	20,000	25,000	45,000
5. Project management budget/cost*	45,000	25,000	70,000
<b>Total project costs</b>	<b>1,114,000</b>	<b>250,000</b>	<b>1,364,000</b>

\* This item is an aggregate cost of project management; breakdown of this aggregate amount should be presented in the table b) below.

#### b) PROJECT MANAGEMENT BUDGET/COST<sup>2</sup>

<i>Component</i>	<i>Estimated staffweeks</i>	<i>GEF(\$)</i>	<i>Other sources (\$)</i>	<i>Project total (\$)</i>
Personnel*	-	-	-	-
Local consultants*	52	24,500	6,000	30,500
Office facilities, equipment, vehicles and communications			20,000	20,000
Meetings & Workshop			5,000	5,000
Travel			12,000	12,000
Miscellaneous		500	2,000	2,500
<b>Total</b>	<b>52</b>	<b>25,000</b>	<b>45,000</b>	<b>70,000</b>

\* Local and international consultants in this table are those who are hired for functions related to the management of project. For those consultants who are hired to do a special task, they would be referred to as consultants providing technical assistance. For these consultants, please provide details of their services in c) below:

<sup>2</sup> For all consultants hired to manage project or provide technical assistance, please attach a description in terms of their staff weeks, roles and functions in the project, and their position titles in the organization, such as project officer, supervisor, assistants or secretaries.

c) CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

<i>Component</i>	<i>Estimated staffweeks</i>	<i>GEF(\$)</i>	<i>Other sources (\$)</i>	<i>Project total (\$)</i>
Personnel		-		
Local consultants	311	97,520	135,350	232,870
International consultants	47	43,580	97,800	141,380
<b>Total</b>	<b>358</b>	<b>141,100</b>	<b>233,150</b>	<b>374,250</b>



d) CO-FINANCING SOURCES<sup>2</sup> (expand the table line items as necessary)

Co-financing Sources					
Name of co-financier (source)	Classification	Type	Amount (\$)	Status	
				Confirmed	unconfirmed
Non-Ferrous Technology Development Centre	In cash	Contribution	210,000	210,000	-
International Copper Association	In cash	Grant	200,000	200,000	-
International Copper Association	In-kind	Contribution	100,000	100,000	-
Common Fund for Commodities	In cash	Grant	604,000	604,000	-
Sub-total co-financing			1,114,000	1,114,000	-

**Budget Notes**

**Project Management Budget**

**a) Local Consultants**

1 person year (=52 staff weeks) are needed to manage the project over 3 years calculated at the rate of a senior professional contracted long term (USD 30,000 per person year).

**Technical Assistance Consultancy Budget**

**a) Local Consultants**

311 staff weeks are estimated for local consultants providing technical inputs. Most of these will be short term consultancies at a rate of USD 150/day resulting in a staff week cost of USD 750. Here is the equation:  $750 \times 311 = 233,000$ .

**b) International Consultants**

47 staff weeks are estimated for international consultants providing technical inputs. Most of these will be short term consultancies at a rate of USD 600/day resulting in a staff week cost of USD 3,000. Here is the equation:  $3,000 \times 47 = 141,000$ .

**Service Contract "Construction and Engineering" under Outcome 1**

<sup>2</sup> Refer to the paper on Co-financing, GEF/C.206/Rev. 1

Under this contract support will be provided to fabricate, procure and commission machinery and testing equipment at the ETC, including a casting press, which is the key equipment required.

### Total Budget and Work Plan

<b>Award ID:</b>	00047661
<b>Award Title:</b>	PIMS 3489 India Achieving Reduction in GHG Emissions through Advanced Energy Efficiency Technology in Electric Motors
<b>Business Unit:</b>	IND10
<b>Project ID:</b>	00057449
<b>Project Title:</b>	PIMS 3489 India Achieving Reduction in GHG Emissions through Advanced Energy Efficiency Technology in Electric Motors
<b>Implementing Partner (Executing Agency)</b>	ICA

GEF Outcome/Atlas Activity	Responsible Party/Implementing Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Total (USD)	See Budget Note:
<b>OUTCOME 1:</b> Enabling Technology Centres has been set up and is fully functioning.	International Copper Association	62000	GEF	71200	International Consultants	1,500	1,900	2,100	5,500	
				71300	Local Consultants	1,000	1,000	1,000	3,000	
				72105	Service Contract	20,000	0	0	20,000	
				71600	Travel	500	500	500	1,500	
					<b>Total Outcome 1</b>	<b>23,000</b>	<b>3,400</b>	<b>3,600</b>	<b>30,000</b>	
<b>OUTCOME 2:</b> CMR Technology has been assimilated and upgraded	International Copper Association	62000	GEF	71300	Local Consultants	16,200	18,460	19,340	56,000	
				71600	Travel	1,580	1,960	1,860	5,400	
				74500	Consultations & Industry Workshop	3,000	4,000	4,000	11,000	
				72500	Office Supplies	470	400	330	1,200	
				74500	Misc	340	700	360	1,400	
	<b>Total Outcome 2</b>	<b>23,580</b>	<b>25,520</b>	<b>25,890</b>	<b>75,000</b>					
<b>OUTCOME 3:</b> Technology has been	International Copper	62000	GEF	71200	International Consultants	12,600	12,600	12,600	38,000	

transferred & commercialised	Association			71300	Local Consultants	9,200	9,200	9,400	27,800			
				71600	Travel	3,000	5,300	1,200	9,500			
				74500	Consultations & Industry Workshop	5,000	5,000	5,000	15,000			
				72500	Office Supplies	825	1,050	625	2,500			
				74500	Misc	730	700	770	2,200			
					<b>Total Outcome 3</b>	<b>31,355</b>	<b>33,850</b>	<b>29,795</b>	<b>95,000</b>			
				71200	International Consultants		10,000	10,000	20,000			
				71300	Local Consultants							
				71600	Travel		2,500	2,500	5,000			
				74500	Consultations & Industry Workshop							
OUTCOME 4: Monitoring and Evaluation	International Copper Association	62000	GEF	72500	Office Supplies							
				74500	Misc							
					<b>Total Outcome 4</b>		<b>12,500</b>	<b>12,500</b>	<b>25,000</b>			
				71300	Local Consultants	8,200	8,650	7,650	24,500			
				74500	Misc	0	500	0	500			
					<b>Total Management</b>	<b>8,200</b>	<b>9,150</b>	<b>7,650</b>	<b>25,000</b>			
					<b>PROJECT TOTAL</b>	<b>81,525</b>	<b>86,760</b>	<b>81,715</b>	<b>250,000</b>			
				Project Management Unit	PMU	62000	GEF					

Summary of Funds:

GEF	In cash	81,525	86,760	81,715	250,000
Non-Ferrous Technology Development Centre	In cash	52,500	94,500	63,000	210,000
International Copper Association	In cash	50,000	90,000	60,000	200,000
International Copper Association	In kind	25,000	45,000	30,000	100,000
Common Fund for Commodities	In cash	151,000	271,800	181,200	604,000
<b>TOTAL</b>		<b>360,025</b>	<b>688,060</b>	<b>415,915</b>	<b>1,364,000</b>

\* Summary table should include all financing of all kinds: GEF financing, cofinancing, cash, in-kind, etc. etc

## 6. INSTITUTIONAL COORDINATION AND SUPPORT

### a) CORE COMMITMENTS AND LINKAGES

BEE has been working on a Standards and Labelling (S&L) programme for motors, pumps and other motor driven systems such as air conditioners and refrigerators. Also, BEE has been supporting use of energy efficient motors. ICA through ICPCI has been working closely with BEE on these initiatives. The proposed project has direct bearing on the motors S&L program of BEE and standards of the Bureau of Indian Standards (BIS).

### b) CONSULTATION, COORDINATION AND COLLABORATION BETWEEN IAs, AND IAs AND ExAs, IF APPROPRIATE.

ICA has been interacting with the UNDP-GEF office; the Ministry of Power and BEE regularly for discussions on this project.

### c) PROJECT IMPLEMENTATION ARRANGEMENT

The proposed project will be implemented by ICA in close cooperation with BEE and will have direct linkages to other initiatives of BEE. ICA will form a Project Management Unit (PMU) within the organization. This PMU would be guided by a Supervisory Board. This Board could include representatives from the Common Fund for Commodities, UNDP-GEF, NFTDC, ICA, International Copper Study Group (ICSG, intergovernmental organization and project supervisory commodity body), and a nominee of BEE (ex officio – Director General, BEE). The Project Manager will provide overall direction to the project. As head of the PMU, he/she will coordinate the project in close coordination with the team located at NFTDC. This local ECT team will be lead by Team Leader from NFTDC. Team Leader and Project Manager would functionally work under the direct supervision of the Director of Technology of ICA.

#### **International Copper Association (ICA)**

The International Copper Association, Ltd. (ICA) is the leading organisation for promoting the use of copper worldwide. ICA's mission is "to increase awareness and usage of copper by communicating the unique attributes that make this sustainable element an essential contributor to the formation of life, to advances in science and technology, and to a higher standard of living throughout the world." The Association's 38 members represent about 80 percent of the world's refined copper output and are among the largest copper producers, copper alloy fabricators, and wire and cable companies in the world. ICA is responsible for guiding policy and strategy, and funding international initiatives and promotional activities. Headquartered in New York, ICA's programmes and initiatives are executed in over 50 countries through four regional offices and 27 Copper promotion centres.

#### **Enabling Technology Centre (ETC)**

ICA evaluated alternative options to establish ETC in most effective manner. ICA has following two principal alternative routes to follow:

1. To form a green-field institution and nurture process development and adaptations. This would involve procurement of all the necessary machinery and equipments. Develop new team to undertake process development.



2. To work with an existing institution have requisite skills sets and equipment to support CMR Technology developments and optimization.

ICA opted for the second route after evaluating options. For the purpose, ICA undertook evaluation of existing capabilities/competencies within India in the area of copper casting and die casting process with institutions and industry. ICA clearly defined its requirements by identifying features of ideal partner institution as follows:

*Capability / Know-how factors:*

- The institution should have following features:
- Necessary equipments (casting equipment) and skills for melting metal (in pure form)
- Chemical and metallurgical testing laboratory
- Skills to design moulds and mould sets for operation up to 1,250 C
- Demonstrated ability to develop innovative casting processes
- Ability to understand the effects of CMR production on lamination steels
- Advanced motor design skills to optimize motor performance
- Other allied skills

*Organizational Characteristics:*

- Location that permits easy interactions with motor manufacturers
- Ability to attract additional funding
- Successful track record of commercializing technological developments
- Adequate space for CMR process development
- Can attract, train and transfer skilled people to industry

ICA selected Non-Ferrous Materials Technology Development Centre (NFTDC), located in Hyderabad. This institution met most of the features envisioned by ICA.

**Non-Ferrous Materials Technology Development Centre (NFTDC)**

Non-Ferrous Materials Technology Development Centre (NFTDC) is a non-profit research institution based in Hyderabad, in the area of casting and materials development. NFTDC is a registered society. NFTDC has been working in the area of materials development, advance process engineering and precision manufacturing. NFTDC specializes in advanced process know-how and process equipment engineering, which together form core of a technology. Over the years the Centre has developed core competence in the area of vacuum and speciality melting methods, continuous casting, advanced solidification techniques, vacuum sintering and other heat treatment methods. ETC would be established within the premises of NFTDC, located in Hyderabad.

**Details of PMU**

The project management unit (PMU) would comprise of technical and support team established by NFTDC (hereinafter referred to as ETC Team) and led by the Team Leader. Project Manager and ETC Team Leader would work in close coordination for project activities. PMU would be responsible for implementation of the whole project and for achieving the project goals successfully. PMU would primarily have technical skills while Project Manager would have market development skills. In addition, ICA would provide need based support on the market development aspects. Technical team at NFTDC would have specialists in die casting process / metallurgy as well in mould design / manufacture. Die casting process specialists would coordinate trial / pilot batch production at ETC as well as

modification of process parameters. Mould design specialist would support these activities, as copper die casting requires special mould materials for its moulds and inserts are required to be cooled and take away heat mainly due to high melting point of copper.

Project Manager (PM) would be responsible for forging strategic alliances with manufacturers of motors / rotors. PM along with ETC team would continuously track the motor market and would interact with motor manufacturers as well as OEMs and end users to convince them of the benefits as a part of the market development efforts. On the other hand, market team would support coordination of market development as also technology demonstration seminars and training programmes.

ETC Team would also take need based support from consultants and other technical experts from India and abroad.

Other project partner organizations will provide support to ETC Team and operation of ETC. ICA is in the process of approaching various stakeholder groups to submit their expression of interest in order to select project partners. These project partners would provide services such as:

- Motor design's and selection of frames for rotor manufacture
- Rotor testing and motor testing
- Metallurgical knowledge and inputs to optimize process parameters
- Chemical and metallurgical tests in laboratory (to examine materials, test composition)
- Mould inserts design and manufacture
- Making training facilities available for holding training seminars and conferences
- Providing market data and other relevant details.

These services/ support would be secured from variety of stakeholder organizations including motor manufacturers, their associations, test laboratories, tool rooms, etc. Some of these organizations have indicated interest in associating with the project to ICA.


## 6. REQUIRED ATTACHMENTS

- c) Report on the Use of Project Preparation Grant (if used)

No PDF or PPG funds have been used. The preparation of the proposal has been funded by ICA.

- d) Country Endorsement Letter (RAF endorsement letter if BD or CC project)

The letters dated 20 September 2006 and 13 November 2006 confirm re-endorsement of this project and acceptance into the 2007 pipeline.

 Ramesh Ramankutty  
09/23/2006 03:58 PM

Extn: 52725                      GEF  
Subject: Fw: Endorsement Letters from India for GEF 4- Part II  
File to RIS Status: Submitted for processing into RIS

— Forwarded by Ramesh Ramankutty/Person/World Bank on 09/23/2006 03:58 PM —

Monique Barbut  
09/22/2006 02:30 PM                      To: Ramesh Ramankutty, Patricia A. Bliss-Guest  
33292 GEF                                      CC:  
Subject: Fw: Endorsement Letters from India for GEF 4

— Forwarded by Monique Barbut/Person/World Bank on 22/09/2006 14:29 —

mital\_sudhir  
22/09/2006 06:59                              To: mbarbut@TheGEF.org  
    CC: r\_p\_singh@nic.in, neyanika.singh@nic.in  
Subject: Re: Endorsement Letters from India for GEF 4

Dear Ms. Barbut,

This is in continuation to my email dated: 20<sup>th</sup> September 2006 endorsing and re-endorsing 14 project proposals from biodiversity and climate change focal area under country RAF allocation.

For two of the following project proposals, the amount to be allocated from India's country allocation was stated incorrectly. These project are:

- 1) Transfer of Technology for High Pressure Copper Die Casting in India (UNDP)
- 2) Conservation of Biodiversity Rich Sacred Natural Sites (UNEP)

The revised endorsement letters for both the project proposals is attached for record.

With warm regards  
Sudhir Mital

Mr. Sudhir Mital



To: Ms. Monique Barbut  
CEO, Global Environment Facility

F. No. 4(1)/16/2006 - IC 6SD.1  
Dated: 22<sup>nd</sup> September 2006

भारत सरकार  
पर्यावरण एवं वन मंत्रालय  
GOVERNMENT OF INDIA  
MINISTRY OF ENVIRONMENT & FORESTS

Re: Encouragement Letter for 'Transfer of Technology for High Pressure Copper Die Casting in India'

This is in continuation with our letter dated: 19<sup>th</sup> September 2005 re-endorsing the project titled 'Transfer of Technology for High Pressure Copper Die Casting in India' to be proposed through the United Nations Development Program (UNDP) to the Global Environment Facility (GEF) for funding under GEF 4.

The allocation for this project is USD 0.250 million of the GEF climate change funds available in India through the GEF Resource Allocation Framework to this project and not USD 1.0 million as earlier stated. This may please be taken on record.

We regret the inconvenience thus caused

Yours sincerely

(SUDHIR MITAL)  
Joint Secretary  
and, GEF Operational Focal Point India  
Ministry of Environment and Forests  
Government of India

Cc: Mr. Rajeev P Singh, Director, DEA, North Block, New Delhi  
Dr. Maxine Olson, Resident Representative, UNDP Co, 55 Lodhi Estates  
New Delhi  
Mr. Marcel Alers, Climate Change Manager, UNDP/GEF, New York



एवं ई प्रतिलिपि।  
एवं ई प्रतिलिपि।

पर्यावरण मन्त्र, सी.जी.ओ. कॉम्प्लेक्स, लोधी रोड, नई दिल्ली - 110 003  
PARYAVARAN BHAWAN, C.G.O. COMPLEX, LODHI ROAD, NEW DELHI - 110 003

- e) Confirmed letters of commitments from co-financiers (with English translations)

## COMMON FUND FOR COMMODITIES

**Postal Address:**

Postbus 74656  
1070 BR Amsterdam  
The Netherlands

E-mail: [coo@common-fund.org](mailto:coo@common-fund.org)  
Telex: 12331 cfc nl

Ref No : OPS/06/039

Stadhouderskade 55  
1072 AB Amsterdam

Tel. Direct Line: (31 20) 575 4949  
Telefax: (31 20) 676 0231  
Internet: [www.common-fund.org](http://www.common-fund.org)



pac

Date: 25 February 2008

Mr. Martin Krause  
Regional Technical Advisor - Climate Change  
UNDP Regional Centre in Bangkok  
3rd Floor, UN Service Building  
Rajdamnern Nok Avenue, Bangkok, Thailand

Dear Mr Krause,

The Common Fund for Commodities, an intergovernmental financial institution in Amsterdam, the Netherlands, established under an agreement within the United Nations Conference on Trade and Development, has committed US\$604,000 to the International Copper Association, our Project Implementing Agency, to finance the project which the CFC, being an institution in support of commodities, titled "Transfer of Technology for High Pressure Copper Die Casting in India" - reference CFC/ICSG/05.

Our commitment, against which multiple disbursements have already been made, compliments the co-financing from the International Copper Association (ICA) and from the Non-Ferrous Materials Technology Development Centre (NFTDC), and the expected and appreciated contribution from the Global Environment Facility, against the MSP introduced by UNDP-GEF as project "Achieving Reduction in GHG Emissions through Advanced Energy Efficiency Technology in Electric Motors".

To-date, housing of and equipment for the "Enabling Technology Centre" have been installed in Hyderabad, India at the NFTDC, and work is in progress to design high energy efficiency motor systems, using cast copper motor rotor technology. The development work will benefit India and contribute to economic development and climate change mitigation.

We hope that a representative of the UNDP-GEF will participate in the next steering committee, including the mid-term review of the project, next 15-16 May 2008 in Hyderabad at the NFTDC, and that GEF funds will be available by then, to allow the successful completion of the project.

Yours Sincerely,

Guy Sneyers  
Chief Operations Officer





24 March 2006

United Nations Development Programme – Global Environment Facility

Mr. Marcel Alers

Climate Change Manager

304 East 45<sup>th</sup> Street

New York, NY 10017

**Subject: Medium Sized Project Proposal - PIMS 3489- Achieving Reduction in GHG Emissions through Advanced Energy Efficiency Technology in Electric Motors**

Dear Mr. Alers,

Reference is made to the UNDP-GEF Medium Sized Project Proposal - PIMS 3489.

The International Copper Association, Ltd. (ICA) welcomes this opportunity to work with UNDP and reconfirm ICA's commitment to pursue with UNDP a successful outcome for this project.

ICA today is expending significant funds to develop new and advanced technologies to improve the energy efficiency of electric motors in a cost-effective manner. We will work with UNDP to increase in India the use of high efficiency motors and motor systems using the advanced technologies developed.

ICA is pleased to reconfirm that US\$ 1,114,000 has been committed to the financing of the project over the three year period provided for in the Project Proposal. The Common Fund for Commodities (CFC) has approved \$604,000 under a Project Agreement between the CFC, the International Copper Study Group, and ICA. The commitment of the The Non-Ferrous Materials Technology Development Centre (NFTDC) in Hyderabad is \$210,000 under a contract between the NFTDC and ICA. ICA has committed \$300,000 in support of specific project activities. ICA's actual expenditure in this field, however, may exceed the commitment previously mentioned because of ICA's funding in general support of GHG emission reductions, and ICA's continuing and ongoing promotion of energy efficiency for electric motor systems.

We view this project as an opportunity to work together on an important and exciting step forward to improve the efficiency of motors and motor systems in India, with all of the attendant benefits.

With best regards,

A handwritten signature in dark ink, appearing to be "J. M.", written over a horizontal line.

Francis J. Kane  
President  
International Copper Association, Ltd.

cc: John R. Mollet – International Copper Association

- f) Agency Notification on Major Amendment and provide details of the amendment, if applicable.

N/A

### PART III - RESPONSE TO PROJECT REVIEWS

- a) Convention Secretariat comments and IA/ExA response
- b) STAP expert review and IA/ExA response (if requested)

GEF Secretariat and other Agencies' comments and IA/ExA response

Copper MSP – Response to GEFSEC Review Sheet

Concerns	Response	Reference
<p>Sr. No. 1: The proposal provides an overview of EE copper cast motors but gives no information on the costs or benefits these motors. The proposal indicates that high initial costs and lack of understanding about the life cycle costing are major barriers to the adoption of the new technology. What is that status of CMR technology development and commercialization in the U.S. and Europe? Is there life-cycle costing analysis? What is the typical payback period?</p>	<p>At a given efficiency level, the copper rotor allows motors to be generally smaller, lighter and up to 15% less expensive. Multiple analyses have shown 15 to 20% reduction in motor losses achievable with copper rotor compared to same motor design using aluminum because the conductivity of copper is 60% higher. These reduced losses translate to a 1%-5% increase in nameplate efficiency of the motor.</p> <p>CMR technology has been developed and commercialized by very large motor manufacturers in US and Europe. These companies have developed this technology on their own in their well established R&amp;D laboratories. Technology thus developed is not available for transfer at large. Even if one motor manufacturer opts for technology transfer by paying the high fees, such a transfer fee would make the ultimate product uneconomic. The purpose of developing the technology is to transfer all interested motor manufacturers in India and other neighboring South Asia Countries.</p>	<p>Proposal has been updated in section 3. Programme Designation and Conformity</p>
<p>Sr. No. 2: The proposal mentions markets in other Asian countries. But since the market potential in India is enormous, market development and penetration as well as project replication should focus on India. (Also see comment on CO2 emissions estimate.)</p>	<p>Agreed. This project will focus on Market development efforts in India first.</p>	<p>References in the proposal to other Asian markets has been deleted.</p>
<p>Sr. No. 3: The project proposes a</p>	<p>Please see response to each indicator. The logframe has been</p>	<p>Logframe has been</p>

Concerns	Response	Reference
<p>number of indicators on p. 11 and in the logframe. Some of them need to be sharpened and be "SMART" per M&amp;E policy, including:</p>	<p>updated.</p>	<p>updated.</p>
<p>Sr. No. 3a: - Banks and financing agencies indicating interest in developing schemes to promote high efficiency copper rotor motor -- how to measure?</p>	<p>Revised Indicator: At least one Bank or Financing agency (NBFC) launches a scheme to finance energy efficient motors / products.</p>	<p>Logframe has been updated.</p>
<p>Sr. No. 3b: - Increased market share of high efficiency copper rotor motors -- not specific (baseline is unclear)</p>	<p>Proxi indicator: Number of enquiries received from end user organizations and OEMs who use motors. At least 10 enquiries could indicate successful market seeding and indicator of market development.</p>	<p>Logframe has been updated.</p>
<p>Sr. No. 3c: - Cost-effective commercialization of the process -- how to define and measure?</p>	<p>This indicator has been deleted.</p>	<p>Logframe has been updated.</p>
<p>Sr. No. 3d: - Better commercialization prospects -- how to define and measure?</p>	<p>At least two technology transfer agreements to be signed with manufacturers interested in acquiring the technology.</p>	<p>Logframe has been updated.</p>
<p>Sr. No. 3e: - Cost-benefit indicating economical production -- how to define? The baseline is "CMR process has been established at laboratory level -- where? Has the technology been commercialized in the U.S. and Europe?</p>	<p>CMR technology has been developed and commercialized by very large motor manufacturers in US and Europe. These companies have developed this technology on their own in their well established R&amp;D laboratories. Technology thus developed is not available for transfer at large. Even if one motor manufacturer opts for technology transfer by paying the high fees, such a transfer fee would make the ultimate product uneconomic. The purpose of developing the technology is to transfer all interested motor manufacturers in India and other neighboring South Asia Countries.</p>	<p>Proposal has been updated in section 3. Programme Designation and Conformity</p>
<p>Sr. No. 3f: - Number of tech transfer</p>	<p>There was an error (inconsistency). It should read: At least two</p>	<p>Logframe has been updated.</p>

Concerns	Response	Reference
<p>agreements (one or two?): Inconsistent between logframe and project description.</p> <p>Sr. No. 4: A more detailed M&amp;E plan is needed, including a separate M&amp;E budget, an independent (mid-term and) terminal evaluation, etc. Since ICA is the primary proponent of this project and it has a vested interest in promoting copper use, it is important to ensure objectivity and impartiality of the technical assessment (costs and benefits, pros and cons, etc.) of the CMR technology through project implementation and evaluation.</p>	<p>technology transfer agreements. This has been corrected.</p> <p>An M&amp;E plan has been incorporated into the proposal.</p>	<p>updated.</p> <p>Please see updated M&amp;E section.</p>
<p>Sr. No. 4: *The co-financing table on p. 19 is inconsistent with that of the cover page. GEF Agency (UNDP?) should be GEF: this (250k) is GEF financing, not co-financing.</p> <p>*There needs to be a link between the financing/co-financing and budget tables on pp. 19 and 24. What is the breakdown of co-financing by project component?</p> <p>*There is a letter of co-financing commitment from ICA for a total amount of \$1.114m. ICA cannot commit on behalf of other co-financing partners (NFTDC, CFC). LOCs are needed from other co-financiers.</p>	<p>Inconsistency has now been removed. GEF Financing is USD 250,000</p> <p>Link between financing and co-financing has been established and inconsistency removed.</p>	
<p>Sr. No. : Core Commitments</p>	<p>Under Energy Conservation Act 2001, BEE is implementing EE S&amp;L program. The proposed project will complement BEE</p>	



Concerns	Response	Reference
	<p>activities by addressing the high initial cost barrier of EE products (motor pumps and motor driven systems).</p> <p>Extending the partnership to air conditioners and refrigerator compressors manufacturers could help to improve coefficient of performance (EER).</p> <p>At this stage there is no direct linkage established with the other GEF proposal, however it may complement efforts of UNDP-GEF project - "Market Transformation for EE AC and Refrigerators" after demonstrating relevance of this technology to compressor manufacturers.</p> <p>BEE Role: BEE is an invitee member of the Steering Committee for the project to provide advice on project implementation.</p>	

Annex 1: Motor Market Data, Electricity Savings and CO2 emission reduction calculations

Table 1: HEM Motors Market Data

	Data	Source
Average motor size	5.5 kW	Manufacturers' Associations
Average operating hours	4,000	Based on Industry user feedbacks
Average electricity consumption per motor kWh (Based on Avg Loading of 60%)	16,098	Average efficiency as per IS 8789
Base year	April 2005-March 2006	
Stocks in Nos Installed	10,500,000	ICA estimate based on sum of motors sold in last 10 years
Sales Nos	1,450,000	Assumption - No of unsold motors stock is same as previous year
Total Electricity Consumption (GWh)	192,366	
% of total Electricity consumption accounted by electric motors (For Industries + Commercial)	35%	
Limits of motor Efficiency		As per Bureau of Indian Standards(IS 8789) Voluntary
Electricity Consumption	82%	
Efficiency improvement	89.5%	NEMA Premium Target Efficiency
Equipment life time - (Needed for HEM replacement considerations)	10 Years	
Forecast annual Sales of motors		
% of annual sales accounted for by HEMs (W/O MEPS, energy label etc)	CAGR 10%	
Forecast efficiency increase (baseline & alternate scenario)	Nil	
Assumed effects of energy labels and/or MEPS	Target penetration of HEM - 20% at the end of 10 Years	

% Savings due to energy labels with out MEPS (Impact assumed on the base year stocks)	2.4%	
% Savings due to MEPS (impact assumed on base year stock)	4.3%	

Table 2: Market Penetration and Electricity Savings

Year	1	2	3	4	5	6	7	8	9	10
Market Penetration Rate of HEMs	0%	1%	3%	5%	8%	10%	14%	17%	19%	20%
No of HEMs sold	0	14,500	43,500	72,500	116,000	145,000	203,000	246,500	275,500	290,000
Accum No of HEMs operating	0	14,500	58,000	130,500	246,500	391,500	594,500	841,000	1,116,500	1,406,500
Elect. Savings in kwh		4,422,500	17,690,000	39,802,500	75,182,500	119,407,500	181,322,500	256,505,000	340,532,500	428,982,500

Table 3: CO2 Emission Calculation

Elect. Savings in GWh over 3 years	17.7
Elect. Savings in GWh over 10 years	429
HEM elect consumption in kwh	15,793
Normal elect consumption in kwh	16,098
Savings per motorly in kwh	305
Annual Average of CO2 emissions in t/GWh	840
Tonnes of CO2 emission reduction over 3 years	14,868
Tonnes of CO2 emission reduction over 10 years (direct)	360,360

**ACRONYMS USED**

Sr. No.	Abbreviation	Expansion / Stands for
	BEE	Bureau of Energy Efficiency
	BIS	Bureau of Indian Standards
	CFC	Common Fund for Commodities
	CMR	Copper Motor Rotor
	EE	Energy Efficiency
	EFF1	Efficiency 1 under BIS Standard for energy efficient Motors
	ERDA	Electrical Research and Development Association, Vadodara, Gujarat
	ETC	Enabling Technology Centre
	GEF	Global Environment Facility
	ICA	International Copper Association, Ltd.
	ICPCI	International Copper Promotion Council (India)
	ICSG	International Copper Study Group
	NFTDC	Non-Ferrous Materials Technology Development Centre
	S&L	Standards and Labeling
	UNFCCC	United Nations Framework Convention on Climate Change