PROJECT IDENTIFICATION FORM (PIF) [1]

PROJECT TYPE: Full-sized Project
TYPE OF TRUST FUND:GEF Trust Fund

PART I: PROJECT IDENTIFICATION

Project Title:	Facility for Low Carbon Technology Deployment		
Country(ies):	India	GEF Project ID:[2]	
GEF Agency(ies):	WB (select) (select)	GEF Agency Project ID:	P128921
Other Executing Partner(s):	Bureau of Energy Efficiency	Submission Date:	2012-03-15
GEF Focal Area (s):	Climate Change	Project Duration (Months)	60
Name of parent program (if applicable): ➢ For SFM/REDD+ ☐		Agency Fee ($):	900,000

A. FOCAL AREA STRATEGY FRAMEWORK[3]:

Focal Area Objectives	Expected FA Outcomes	Expected FA Outputs	Trust Fund	Indicative Grant Amount ($)	Indicative Co-financing ($)
CCM-1 (select)	Technologies successfully demonstrated, deployed, and transferred	Innovative low-carbon technologies demonstrated and deployed on the ground	GEFTF	8,800,000	59,000,000
(select) (select)			(select)		
(select) (select)			(select)		
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(select) (select)			(select)		
(select) (select)			(select)		
(select) (select)	Others		(select)		
		Sub-Total		8,800,000	59,000,000
		Project Management Cost[4]	(select)	**200,000**	300,000
		Total Project Cost		9,000,000	59,300,000

B. PROJECT FRAMEWORK

Project Objective: To facilitate deployment of low carbon technologies in India that can address technology gaps to mitigate climate change and improve the economy's energy efficiency

Project Component	Grant Type	Expected Outcomes	Expected Outputs	Trust Fund	Indicative Grant Amount ($)	Indicative Cofinancing ($)
Competitive Awards	Inv	Improvement in the technology base for priority low carbon energy solutions. Adoption of improved technologies in the Indian economy, reducing need for new energy generation	Implementation of awards to reward targeted innovation and development to meet identified climate technology needs Identification of appropriate networks and centers for research and	GEFTF	6,160,000	57,000,000

[1] It is very important to consult the PIF preparation guidelines when completing this template.
[2] Project ID number will be assigned by GEFSEC.
[3] Refer to the reference attached on the Focal Area Results Framework when filling up the table in item A.
[4] GEF will finance management cost that is solely linked to GEF financing of the project.

		capacity	deployment of different climate mitigation technologies.			
Technical Assistance for Support Facility	TA	Establishment of deployment support eco-system for energy efficiency	Establishment of Technology Transfer Support Facility, which will consitute of a Hub, technology-specific Application-oriented Deployment Groups and Technology Transfer Support Cell Consultations/ workshops with international/ national experts, with documentation and dissemination of the Facility.	GEFTF	2,640,000	2,000,000
	(select)			(select)		
	(select)			(select)		
	(select)			(select)		
	(select)			(select)		
	(select)			(select)		
	(select)			(select)		
	(select)			(select)		
	(select)			(select)		
Sub-Total					8,800,000	59,000,000
Project Management Cost[5]				(select)	200,000	300,000
Total Project Costs					9,000,000	59,300,000

C. INDICATIVE CO-FINANCING FOR THE PROJECT BY SOURCE AND BY NAME IF AVAILABLE, ($)

Sources of Cofinancing	Name of Cofinancier	Type of Cofinancing	Amount ($)
Private Sector	Private entities	Unknown at this stage	50,000,000
National Government	Government of India	Grant	9,000,000
Others	Private entities/ GOI (TBD)	Unknown at this stage	300,000
(select)		(select)	
(select)		(select)	
(select)		(select)	
(select)		(select)	
(select)		(select)	
(select)		(select)	
(select)		(select)	
Total Cofinancing			59,300,000

D. GEF/LDCF/SCCF RESOURCES REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY[1]

GEF Agency	Type of Trust Fund	Focal Area	Country Name/Global	Grant Amount (a)	Agency Fee (b)[2]	Total c=a+b
WB	GEF TF	Climate Change	India	9,000,000	900,000	9,900,000

[5] Same as footnote #3.

(select)	(select)	(select)				0
(select)	(select)	(select)				0
(select)	(select)	(select)				0
(select)	(select)	(select)				0
(select)	(select)	(select)				0
(select)	(select)	(select)				0
(select)	(select)	(select)				0
(select)	(select)	(select)				0
(select)	(select)	(select)				0
Total Grant Resources				9,000,000	900,000	9,900,000

[1] In case of a single focal area, single country, single GEF Agency project, and single trust fund project, no need to provide information for this table

[2] Please indicate fees related to this project.

PART II: PROJECT JUSTIFICATION

A. DESCRIPTION OF THE CONSISTENCY OF THE PROJECT WITH:

A.1.1 the GEF focal area/LDCF/SCCF strategies:

Adoption of advanced technologies in the market has been identified as one of the critical tools available for climate change mitigation and adaption. The GEF document on focal areas identifies Technology Transfer as a prime area of focus for the Fifth Replenishment under CCM-1.

This proposed Facility will facilitate and advance technology transfer across sectors, industries, academia and countries to promote energy efficiency and other climate change mitigation measures. This facility is being proposed by the Government of India under its comprehensive measures to combat climate change, without compromising the emerging economy's growth path to alleviate poverty.

This facility will bring industry, academia, research institutions and new and existing enterprises to solve specific challenges and meet identified technology gaps through facilitating deployment and dissemination of emerging technologies. It will be targeted on priority areas, using expert advice and will promote competition within and amongst innovators and institutions to find new technologies and processes to solve priority challenges.

A.1.2. For projects funded from LDCF/SCCF: the LDCF/SCCF eligibility criteria and priorities:

A.2. National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. NAPAS, NAPs, NBSAPs, national communications, TNAs, NIPs, PRSPs, NPFE, etc.:

The Government of India's National Action Plan on Climate Change (NAPCC) identifies technology transfer and adoption as amongst the major pillars to help India meet its climate change mitigation goals. This proposed plan is also in sync with the *Report of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention,* decided at the Durban Conference of Parties in December 2011.

The proposed Facility will help Indian and other countries' entities to work collaboratively on solving the major prioritized climate mitigation technology challenges, guided by industry and academic experts. Such use of local knowledge meets with the criteria for World Bank support to Middle Income Countries (MIC).

The Indian National Communication provides for technology transfer and deployment as critical components of the toolkit to fight climate change. The project will be seeding an innovation ecosystem, driven by rewards, to assist in the development and deployment of technologies across academia, industrial sector, government and autonomous research centers in the country and abroad. This Facility will coordinate with other similar international efforts, as is critical for sharing and creating knowledge that can help mitigate climate change. It is proposed that the selected institution will be part of the network with the Climate Technology Centers Network (CTCN) and can play the connecting node with other climate technology centers in developing countries. It is expected that results of experiments such as this are likely to provide experience and inputs for the National Innovation Fund.

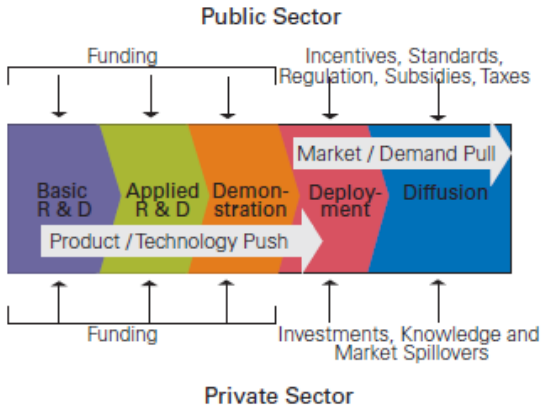
B. PROJECT OVERVIEW:

B.1. Describe the baseline project and the problem that it seeks to address:

In the growing economy of India, energy usage is expected to increase five to eight fold between 2010 and 2030, in order to maintain the growth and development necessary to alleviate poverty by increasing electricity access for 350 million people. Improving energy access to such a large number of citizens without seriously compromising on India's own climate mitigation goals will require technology diffusing and adoption from within the country and outside. India's National Innovation Act of 2008 identifies technology development and adoption as one of the critical inputs for inclusive growth in the country.

Adoption and commercialization of technologies is identified as one of the crucial tools for countering climate change under the UNFCCC as well as the GEF *Results Framework for the Fifth Replenishment*. Technology transfer allows more efficient utilization of resources through wider adoption of technologies discovered in one part of the world or one sector of the economy. To scale up technologies beyond the bench scale experiments, assured demand provides an important driver. Collaboration with large industries that can provide demand under a national program will create incentives for greater innovation.

Innovation literature documents the five stages of deployment of a technology: (a) Discovery of new technology options through basic research and development; (b) Applied research and development to tailor the new technologies to identified purposes; (c) Demonstration of new technologies at laboratory or small scales; (d) Deployment of the first few prototypes; and (e) Widespread diffusion commercial use of the new technology.



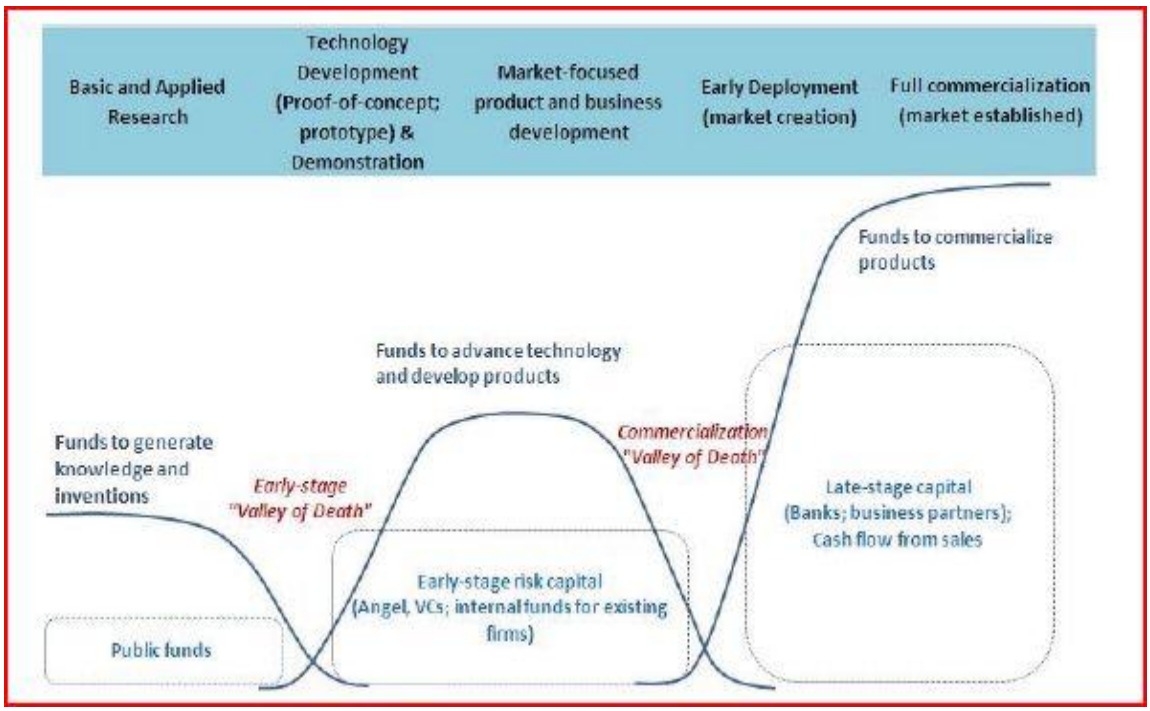
{Adapted from *Technical Summary, in Climate Change 2007: Mitigation, Contribution of Working Group III to Fourth Assessment Report of IPCC* and used in *GEF 5 Focal Area Strategies document}*

It is seen that the first and last stages are well-managed globally, through research institutes and commercial enterprises, respectively. The middle two stages are far less successful, due to several reasons like variance in risk-reward relationships for the various entities, uncertain returns to investment, long gestation periods of returns, etc. These middle stages constitute the famous 'Valley of Death' for innovation, which

frequently stall efforts to find technological solutions to challenges. The Second Valley of Death, as seen in the chart below, shows the failure of proven technologies to reach significant scale.

This Valley Of Death emanates from risk aversion of the different stakeholders in the innovation chain, like commercial lenders, adopters, etc. This lack of support of early-stage technology prevents successful alternatives from reaching their potential in the market. Several sectors like health, telecommunications, transport, etc. have seen such market failures, leading to sub-optimal outcomes.

Several initiatives have been taken up to overcome this market failure, including establishment of publicly funded research centers, innovation awards, research grants, etc. In the energy and climate change sector, such initiatives on a large scare are in a nascent phase and this proposal presents a crucial effort to improve the technology transfer environment in the emerging economy of India. Several projects in India and abroad have successfully bridged the Valley of Death of commercialization in small applications. One of India's most successful examples was the TERI - Swiss Development Corporation-funded project on gasifier introduction in foundries and glass furnaces of India. This project, managed and implemented by TERI, was able to shift India's glass industries to a lower energy consumption technology, which was already available. Several fields like vaccine design, aviation and space science and telecommunications and internet, with low private but high social returns, have needed social support through awards to overcome the Second Valley of Death. In yesteryears, the most famous technology deployment that came out of awards was commercial aviation in India, which was helped by the Aga Khan award for the first flight between India and England[6].



{Adapted from "*Climate Innovation Centers: Advancing Innovation to meet Climate*

[6] http://www.tatasteel100.com/people/wings-for-nation.asp, accessed March 23, 2012

and Development Challenges" by Ambuj Sagar, IIT Delhi}

Due to the regulated nature of the energy industry in most countries, investments in new energy technologies have been stunted over the past decades. To overcome these market failures, public intervention is required. The barriers to this valley of death in India context pertain to following:

- Absence of a connector or facilitator between academician, research agencies and private sector on applications and commercialization of given technologies
- Limited incentives for output or outcome linked commercialization of new technologies. In a rapidly growing economy, incentives are on expansion rather than innovate and adopt new technologies.
- Addressing legal and regulatory challenges related to innovation and intellectual rights of new technologies being commercialized.

The proposed project would act as a *connector* between several entities undertaking near-deployment trials and prototyping of several kinds. The project would seek to provide a top down assessment of innovation needs in specific industry segments of energy efficiency, thus focusing prototyping of technology in specific outcomes. The GEF resources for the energy industry in India will provide the incentives required to attract innovators to the field.

To achieve this goal, the GEF grant will be used to:

- Identify technology gaps that can be addressed through networks of innovation.
- Set up an IT-enabled system to promote virtual collaboration and cooperation amongst several kinds of research institutes and innovators. This component will be the key determinant of the success of the Facility and will have to be carefully created, with full support of the stakeholders. The details of IT enabled system would be developed during project preparation.
- Award performance-linked grants to innovators and developers who can help in deploying currently available technology to meet the needs of specific applications.

The structure of the project will be as follows:

Component 1: Competitive Awards (70% of the GEF grant or USD 6.16 mn): The targeted investments for these identified technology gaps will focus around proto-typing and pre-competitive, innovative technologies that could have significant long-term GHG reduction potential. This component utilizes performance-based awards, which have been shown to have large impact on inspiring innovation. Some similar awards which have inspired large scale networked innovation include the X-Prize for space technologies, the Netflix Prize for optimization of matching algorithms, etc. Much on lines of these competitions, the Facility will institute awards based on reaching set technological goals and/or specifications, with assistance from global and national domain experts. Several other examples, including those of aircraft, space craft, optimization software, computer applications, unmanned aircraft and self-healing robots can be cited as technologies that have emerged from competitive innovation awards. Such innovation awards inspire innovation in several kinds of entities like research centers, university labs and even start-ups, putting private capital into science and technology. Details of the sizes of competitive awards will be provided at the stage of CEO endorsement for investment. Performance targets will include multiple criteria to address advanced energy efficiency performance in the four technology areas;

environmental benefits (e.g., GHG emissions reduction; refrigerants with low or zero global warming potential; zero use of POPs, low air pollution, etc.); consumer needs; cost-effectiveness; and other criteria that will inspire innovation and help achieve national and global goals.

Component 2: Technical Assistance for Support Facility (30% of GEF Grant or USD 2.64 mn): The proposed Facility would work through the following three parts:

- The Hub: An ever-evolving and continuously-changing panel of subject experts selected by the host institution housing the Facility comprising of technologists, innovation experts and industry representatives will identify innovation needs and design appropriate reward mechanisms particular to each identified gap. This Hub will establish and manage the performance-linked grants so as to achieve the stated objectives in each of the areas of intervention, like air-conditioning, etc.
- Application-oriented Deployment Groups: The heart and soul of the innovation facility, these deployment groups will be identified by the Hub to help deploy the chosen technologies in participating institutions. The selection will be based on criteria set by the Hub. These groups will work together in a virtual setting, coordinated by the Hub, to deploy early prototypes of new technologies. These groups will be quickly disbanded when appropriate solutions have been reliably implemented and commercialized.
- Technology Transfer Support Cell: This group of professionals will work directly with the Hub to bring innovations to the market, providing legal support, IP assistance, venture incubation, etc. This group will work with the industry partners to arrange technology trials, early adoptions and scaling-up, with the support of the Hub and Innovation Groups.

Apart from these three entities, association with the GEF and the World Bank will also be a crucial part of the Facility. This collaboration will help bring international expertise in technology, research, early stage incubation, etc to create a platform to support India's innovation ecosystem. The World Bank's expertise in institution building and the GEF's capacity in Innovation for the environment will bring together a set of established and accepted good practices to the Indian research world.
In order to absorb the knowledge and lessons learnt from other such similar initiatives, the task team will undertake consultations with the Department of Science and Technology, the part of the Government of India entrusted with research and development. The consultations will also include participation in design and oversight.

This Facility will start with focusing on four key areas of :

- **Low-grade Waste Heat Recovery:** An estimated 40% of improved energy used in the country is used for industrial applications. A fairly large share is wasted as process heat. This heat is at high temperatures enough to boil water to generate steam, but not enough for use within the industry. There are some technologies in industries like cement which can harness this waste heat economically, but there is a vast gap to be met in other sectors and processes. It is expected that some of the initial efforts through the Facility will be focused on disseminating waste heat recovery solutions that have been discovered in some industries. Due to the large share of waste heat in industrial processes, this sector is likely to have a huge

impact on energy consumption reductions.

- **Air-conditioning:** In a tropical and sub-tropical country like India, the air conditioning needs for comfort are severely under-served. Due to a mix of high costs of electricity and low incomes, the demand for air conditioning has historically been very low. However, with rising incomes, the demand is rapidly growing. For example, for the capital city of Delhi, peak demand for power during hot days goes up by as much as 40% on hot days, with temperatures often exceeding 40°C!
  In the context of a growing economy, it can be envisaged that the demand for air conditioning in homes and establishments will increase exponentially. Therefore, deploying near-commercial technologies that can provide cooling without the concomitant energy consumption will assist the country in slowing its emissions growth. These technologies can be replicated in other tropical and arid countries, reducing global emissions growth.
- **Refrigeration:** In an economy like India where an estimated 70% of the population is still reliant on agriculture for its livelihood, refrigeration of farm produce will help in increasing rural incomes by raising the value of agricultural produce. News reports routinely claim that food grains rot in the country with substantial poverty and 60% childhood malnutrition. The government is also considering a food cold storage policy to encourage growth of cold storage chains in the country to reduce wastage of food. The biggest constraint to increased use of cold storages in the country has been the high energy consumption and the high cost of electricity. More energy efficient cold storage chains would help India achieve the goals of hunger reduction and increasing rural incomes, providing a shot in the arm for poverty reduction. Cold storage innovations have been seen in some sectors, but customized solutions for different sectors are few and far in between. The deployment of such technologies will help bring down costs and also provide tailored solutions to the needs of different industries.
  Refrigeration has several other uses, which would all benefit from innovations that can reduce the cost of operation. Innovations in providing cheaper refrigeration will be adopted globally, reducing the pace of emissions growth.
- **Lighting:** Lighting is the most widespread use of electricity, being the first application for newly connected households. Innovations in the past two decades have brought down the energy required per lumen of illumination, but more development is required in wider adoption of these technologies. This center will work with several sectors of the economy to find ways to improve adoption of energy efficient lighting in the new constructions in the country.

Targets set by the Hub will act as guides for the innovation ecosystem to evolve new answers. Such an ecosystem will be provided assistance like technology incubation, market entry support, legal services, IP support, etc by the Technology Transfer Support Cell to quickly commercialize successful experiments.

The design of target specifications for awards will be critical to drive innovation to meet market needs. Well-designed award specifications would promote innovation and engineering of available bench-scale solutions for the targeted applications, with best practices to eliminate or reduce the environmental impact.
While pushing the frontiers of currently available technology, it is critical to keep the specifications fairly simple and linked to desirable outcomes, to allow for technological

innovation. As a guiding principle of innovation promotion, the intent should be to induce various different technologies to meet specified outcomes through providing balanced targets, rather than mandate specific technologies to be adopted.
As an illustration, the targeted performance of an air conditioning appliance should be:

- Demonstrated operation of appliance of cooling capacity of 16kJ (single flow) or more per hour (averaged), at an Energy Efficiency Ratio (EER[1]) of 7 or higher,
  - Providing a minimum air flow of 0.54m^3/minute;
  - At an ambient temperature of 27°C and Mean Sea Level;
  - For a duration of 2000 hours in four or less runs (with at least one run of at least 500 consecutive hours);
  - using power supply of 50Hz±2Hz at 220V±20 (to comply with Indian conditions);
- Zero emissions of CFCs, HFCs or any ozone-depleting substances, as defined under the Montreal Protocol. Any refrigerant used in the appliance, except water, should comply with lifecycle environmental impact standards, as defined under the relevant environmental Indian Standards
- The footprint of the appliance should not be more than 1.3m^2, including any auxiliary devices.
- Comply with all relevant provisions of the Electricity Act of the Union of India, 2003, and all other laws applicable in the Union of India (not excluding any international treaties which may apply).
- Comply with, or exceed, all performance and/or safety requirements of *IS: 659 (1964, reaffirmed 2001), IS:732 (1963), IS:2274(1963)* and *IS:660 (1964)* and/or other codes and standards, as applicable, in the Union of India as of the date of submission of prototypes for the competition.

Easily verifiable and universal testing and performance conditions need to be specified upfront, to allow for innovators to design appliances to meet these standards and for objective testing with little or no room for disputes.

A priori assessment of the parallel and co-financing is not viable, given the high variability of such investments. For successful grants, the leverage through private investments in innovation can reach very high multiples. We will use private sources of expenditure in innovation as parallel financing and seek letters of support from industrial organizations like the Confederations of Indian Industry and from the Government of India during project preparation for co-financing. From other such competitive grants in other sectors and countries, it is estimated that such awards inspire parallel investments of more than five times of the award money. Given the nascent stage of such competitions in India, the proposal estimates five times parallel financing leverage, which could be updated with new data during the life of the project.

In order to achieve the best leverage of knowledge of research in similar areas around the world, the Facility would have the mandate to coordinate efforts with other research initiatives in developing and developed countries.

[1]For air conditioners, the energy efficiency is measured in a unit called the Energy Efficiency Ratio (EER). The EER rating of a unit is the cooling output in Btu (British thermal unit) divided by the total electric energy input in watt-hours during the same period. The higher the unit's EER rating the more energy efficient is the appliance. For comparison, the current EER of 5-star A/Cs in India is 3.1, with the super efficient appliance levels reaching 4.86;

B. 2. Incremental /Additional cost reasoning: describe the incremental (GEF Trust Fund) or additional (LDCF/SCCF) activities requested for GEF/LDCF/SCCF financing and the associated global environmental benefits (GEF Trust Fund) or associated adaptation benefits (LDCF/SCCF) to be delivered by the project:

In a country the size of India, innovations and inventions are made every day in different industries, sectors and parts of the country. However, deep gaps in the landscape survive, partly due to lack of information and awareness about viable alternatives found through such innovations. Rapid and effective climate change mitigation requires that new investments be made to link the entities like innovators, enterprises and governments to overcome the Valley of Death.

This GEF funding is requested to help invest in a Facility for Low Carbon Technology Deployments. This Facility would work under the broad guidelines set by the UNFCCC at the Durban Convention.

Challenges like low-grade waste heat recovery provide potential for large scale energy reduction, but solutions are unavailable in the market currently. This facility would help locate critical connections between these players to solve pin-pointed problems identified by networks of experts.

Innovation literature suggests that centralized innovation delivers sub-optimal results when compared to diffuse networks supported by a platform that handles the legalities and fiduciary responsibilities. Instead of creating a centralized brick-and-mortar center, this facility will expressly focus on building networks of several players to bring ideas from the grassroots to the central hubs that will recommend awards. As discussed above, the innovation awards will provide peer-to-peer networks, South-South collaboration and private investments in research to meet the goals stated under the award competition conditions.

The guiding principles of the FLCTD would be (a) Competition and market orientation of innovation; (b) Support for early prototypes established in industries and early adopters; (c) Technology diffusion while maintaining a tradition of strong Intellectual Property (IP) rights; (d) Rigorous and timely selection of early promising concepts; (e) matching the needs of innovation with the risk/reward equation for innovators.
Given the nature of the innovation process, GEF support is crucial to helping establish India's FLCTD, bringing international expertise and funding. The World Bank will avail of its credentials in building institutions and capacities to establish the Facility, with the active cooperation of industry, government, academia and international partners. The Facility will also have the mandates to push for South-South cooperation and provide technology transfer services in countries with similar climatic conditions, where such technologies can be quickly disseminated and adopted.

Estimation of Global Environmental Benefits: GHG Emission Reductions

In the assessment of India's low-carbon growth path, a number of scenarios are developed to demonstrate the different growth paths available to shape India's energy

future.[7] Household electricity is estimated to account for nearly half of electricity demand: thirty percent of this total is comprised of lighting. The assumption for this project-level analysis is that the actions taken under this project will have to contribute to the Government of India meeting the objectives established in the "*All-Out Stretch Scenario"*(Scenario 3) of the Low-Carbon Growth study. Under this scenario, mandatory minimum efficiency standards that evolve from mid-tier efficiency (3 star) ratings are expected to evolve into to international best-practice standards and beyond over the modeling time-period (2010-2031). These standards would be driven by innovations and technologies identified, developed and rewarded under the FLCTD project.

In terms of global environmental benefits, the all-out stretch scenario is estimated to save approximately 163,000 GWh per year by the year 2031, the final year of the model. This quantity of electricity would be equivalent to the electricity generated by forty 500 MW coal-fired power plants. The largest percentage share of electricity (and therefore GHG) saving would be anticipated to come from the Lighting sector, projects to use about 30,000 GWh in 2031, as compared to 120,000 GWh under a scenario consistent with the five-year plan predictions. Consumption from appliances would be reduced to about 60% of their current projection even with the tremendous growth in appliance ownership attributable to increasing incomes. Space conditioning consumption is expected to decrease only slightly, but with a huge increase in demand for energy services.

The FLCTD project is expected to be a five-year project (60 months) and its direct impacts are anticipated to be felt for ten years, or nearly one half of the scenario period covered in the low-carbon growth study. Under the Five-year Plan scenario (analogous to Scenario 2 in the study), minimal savings occur when compared to a "do nothing" baseline (Scenario 1). For purposes of this discussion, ninety percent of the savings projected under the "*All-out Stretch Scenario*" would be anticipated to take place without the support of the FLCTD project. The remaining or last 10% of the projected savings would be attributable to the FLCTD and the resulting gains in technology dissemination. Since the final year for the scenarios is two decades away, the impact of the project is only felt in accounting for one half of these energy and GHG savings. The remainder would be considered post-project savings. The estimated emission reductions over the twenty years of the scenario period and the ten years of the direct impact of the project period are summarized in the table below.

Estimated GHG Savings Attributed to Successful Technology Innovation in Targeted Sectors

Household Appliance	Total Electricity	Electricity Consumpti	Electricit y savings	Addition al	Addition al CO2	CO2 Savin

[7] ESMAP. 2010. "Energy Intensive Sectors of the Indian Economy: Pathways to Low Carbon Growth," World Bank, ESMAP Low Carbon Growth Program. Briefing Note 006/10.

	Consumption Projected by 2031 including under Five-Year Plan Scenario (GWh)	on Projected by 2031 under "All-out Stretch" Scenario, Including FLCTD Technologies (GWh)	attributable to "All-out stretch" scenario excluding FLCTD (GWh)	electricity savings attributable to "All-out stretch" including FLCTD impact (GWh)	savings attributable to FLCTD project t CO2eq*	gs from Ten Years of Project
	A	B	C	D = A – B - C	E = D x 800g/ kWh	F = E x 0.5
Lighting	120,000	30,000	81,000	9,000	7.2 m	3.6 m
Refrigerators	120,000	60,000	54,000	6,000	4.8 m	2.4 m
Cooling /Heating Device	275,000	250,000	22,500	2,500	2.0 m	1.0 m
Total					14.0 m	7.0 m

*Assumes system-wide emissions of 800 g/kWh.

If the FLCTD project is successful in supporting innovative technologies for household lighting, refrigerator, and air-conditioning and heating, by the end of ten years, it would be estimated to reduce 7 m tonnes of CO2 equivalent from India's power sector emission projections, consistent with contributing the final 10% of the savings estimated under the "all-out stretch" scenario of the low-carbon study. Given the proposed GEF contribution to the project of $9 million, this would work out to a unit abatement cost (UAC) of US$1.28 per tonne.

Although these figures seem both optimistic and favorable to the project, two issues need to be borne in mind when trying to place them in context. First, the risks associated with project success are high, as witnessed in the US-DOE study cited in Section B.3. Offsetting this concern on the other hand, is the fact that there is no estimate included in the above for any success with the low-grade waste heat recovery sector. As a result, estimates of global environmental benefits could be higher or lower than those presented in the above discussion. This estimation of global environmental benefits for this project is illustrative and will be revisited and re-estimated during project preparation.

B.3. Describe the socioeconomic benefits to be delivered by the Project at the national and local levels, including consideration of gender dimensions, and how these will support the achievement of global environment benefits (GEF Trust Fund) or adaptation benefits (LDCF/SCCF). As a background information, read Mainstreaming Gender at the GEF.":

Innovation has very uncertain rewards. An evaluation of the returns from innovation funding by the US Department of Energy between 1970 and 2007 showed that while the returns to investments were of the order of 200%, more than 75% of the returns came from just 1% of the investments and more than 70% of the investments delivered no, negative or marginal returns. This uncertainty is widespread across all fields, necessitating social or government funding for innovation.

The proposed facility will enable groups of experts and technology adopters to work together to bring new and underutilized technologies to the market, reducing the need of expansion of generation. The benefits will be spread across sectors of the Indian economy, but may have preponderance in the power and demand side management sectors.

In a growing economy, a pool of funding for climate change mitigation innovation will attract new innovators and technologists, increasing the incentive for path-breaking near-deployment research. This deployment push will have spin-off efforts which will benefit the Indian and global economies.

B.4 Indicate risks, including climate change risks that might prevent the project objectives from being achieved, and if possible, propose measures that address these risks to be further developed during the project design:

Risk	Category	Explanation and Mitigation
Inadequate uptake of innovation support services	L	The interactive and collaborative nature of the network will ensure that the services are suited to those most likely to take advantage of them and provide the correct linkages
Fiduciary rules and regulations prevent customization of funding tools to suit the needs of innovators, thereby undermining the aim of the facility to foster innovation	M	The design of the facility will provide for flexibility and customization of support, in order to meet the goals. Given the unpredictable nature of innovation, proactive support to risk-taking will need to be incorporated in project design.
Lack of trust between different kinds of entities prevents active and effective collaboration on new technologies.	M	The lack of engagement across sectors can party be ascribed to improper avenues for collaboration. This network will focus on eliminating areas of distrust and provide a platform for collaboration to solve the world's big challenges. The network will also have dedicated IP experts and lawyers to delineate the rights of different entities in any commercial operation.
Innovation Support Cell is unable to correctly	M	With the engagement of the Network Hub and the GEF Agencies, the

anticipate and provide the right assistance to bring new technologies to market		Innovation Support Cell will be provided guidance to establish the right facilities to foster innovation. This risk will be further mitigated during preparation of the project.

Risk mitigation of impediments to deployment, like inadequate demand will be addressed at investment stage. Some concepts like volume guarantees may be part of the specifications of the awards, to encourage innovators.

B.5. Identify key stakeholders involved in the project including the private sector, civil society organizations, local and indigenous communities, and their respective roles, as applicable:

Innovation happens in several entities like private sector industry, academia and universities, technology start-ups and research labs. However, collaboration and technology transfer between such entities is rare, due to the different nature of drivers for each. Successful collaboration, like those seen in India's Green Revolution or the White Revolution for milk, requires a coordinating agency tasked with bringing together several players under an umbrella to help align incentives to solve the different pieces of a big problem. For the Green Revolution, the Consultative Group for International Agricultural Research (CGIAR), housed at the World Bank, played a crucial catalytic role in assigning research needs to competent bodies. To face the humongous challenge of climate change, the nature and scale of innovation required will be much higher than previous such attempts.

For the proposed project, the Host agency for the Facility will be competitively selected, based on a combination of technical and financial criteria and innovation support credentials of the institute. The institute will be selected on its ability to understand and inspire innovation in these critical technologies that will determine the country's energy consumption trajectory in the coming decades, while also performing the fiduciary functions required under this grant. It is envisaged that major national institutions like the IITs and IIMs, along with specific niche research institutions, will bid for the mandate to host this Facility. The selection criteria will be decided during project preparation, so as to select an institution which has the credentials and key personal to host this facility and inspire innovation through performance-linked grants and context-relevant incentives that inspire private research in the country.
Consumer assessment and CSO involvement will be incorporated in deployment groups, to ensure market orientation of technology deployment, with details to be finalized as part of project preparation.

B.6. Outline the coordination with other related initiatives:

In the area of climate change, the World Bank Group's InfoDev division is also preparing a Climate Innovation and Entrepreneurship Center, which will focus on the cross-sectoral development of enterprises to harness climate change mitigation opportunities. This center will focus on developing start-ups and enterprises that provide solutions for climate change mitigation, while the GEF-funded FLCTD will focus on deployment and dissemination of technologies that have been identified as critical to

meet energy reduction goals. There is comprehensive coordination between the teams working on these two projects, and the coordination will be continued when the centers are in operation.

C. DESCRIBE THE GEF AGENCY'S COMPARATIVE ADVANTAGE TO IMPLEMENT THIS PROJECT:

The World Bank in India has deep experience with building institutions and frameworks where the country's own expertise can be best harnessed for development. The nature of this proposed Facility suits well with the Bank's engagement in India's emerging economy, with the focus on building networks to build and leverage local capacities. The Bank's Indian energy team has deep engagement with the lead Government of India agency on this project, the Bureau of Energy Efficiency. The Bank will work with the BEE and other industry and academic partners to set up this network with focus on a few technologies early on, to establish the modalities for the system. This system can then be used with many applications, as they get identified.

The proposed structure of Hub and Spokes provide for solving market failure problem of inadequate public funding for commercial deployment of energy technologies that are inherently risky for companies and industries to adopt. The grants can be used by innovators to scale up their prototypes to meet market demands, based on needs identified by experts. Supported by technical assistance and other services, this incubation would allow technologies to reduce energy consumption.

Given the innovative nature of the project, the World Bank will provide project management and supervisory assistance for the Network during its implementation. These services will assist the Bank meet its goals of creating institutions in India, one of the larger middle income clients.

C.1 Indicate the co-financing amount the GEF agency is bringing to the project:

The co-financing amount for an innovation support project is difficult to estimate *ex-ante*, due to the inherently uncertain nature of cooperation from the various stakeholders. Going by experience from other innovation funding projects around the world, it is estimated that each dollar is matched by around five to seven dollars of private research funding. It is estimated that a performance-linked grant under GEF would encourage close to $50-100 million of parallel financing in innovation in the private sector in India. Efforts will be made during the project preparation to further identify the most likely specific sources of research investments.

The Bureau Of Energy Efficiency has requested Rs. 2 billion from the Government of India's five yearly plan for applied research and commercialization of technologies in energy efficiency, of which Rs 450 million (USD 9 million) is committed to be applied for the FLCTD, subject to final approvals. The current in-principle approval of USD 9 mn of co-financing would be finalized during finalization of XII five yearly plan of Government of India(expected in few months time).

For the operational costs of the FLCTD, the project will run on a subscription- and fee-funded sustainable revenue model (with details on total revenue and expenses for the proposed Hub to be developed during project preparation). It is envisaged that the Indian private sector's participation will be available, once a proof of concept for select technology is demonstrated. However, in case there are any funding shortfalls after the end of the GEF project, the Government of India has committed to supporting this Facility through additional budgetary resources.

C.2 How does the project fit into the GEF agency's program (reflected in documents such as UNDAF, CAS, etc.) and staff capacity in the country to follow up project implementation:

The World Bank's engagement with middle income countries like India focuses on helping its clients build institutions and systems which can harness the capabilities of the country's own resources and citizens. In line with this aim, the project will initiate an institution that can convene the various disparate research institutions and bodies in the country to solve Indian and global problems like climate change.

In line with the Bank's commitment to help middle income clients like India achieve the potential of their populations, the network will create a precedent of targeted innovation support that can be replicated for other challenges in the areas of development and growth. World Bank in various capacities (along with IFC and WBI) is involved in promotion of innovation through Development Market place, advisory assistance to National Innovation Council, and global knowledge sharing through Infodev. Infodev is working on a proposal to develop a facility that seeks bottom up (compared to top down innovation needs assessment of this proposal) development of innovation through small grants to entrepreneurs across a range of sectors. The approaches of Infodev and GEF grant are complimentary in nature.

PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S): (Please attach the Operational Focal Point endorsement letter(s) with this template. For SGP, use this OFP endorsement letter).

NAME	POSITION	MINISTRY	DATE *(MM/dd/yyyy)*
Hem Pande	Joint Secretary	MINISTRY OF ENVIRONMENT AND FORESTS, GOVERNMENT OF INDIA	**03/12/2012**

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF policies and procedures and meets the GEF/LDCF/SCCF criteria for project identification and preparation.					
Agency Coordinator, Agency name	**Signature**	**DATE** *(MM/dd/yyyy)*	**Project Contact Person**	**Telephone**	**Email Address**
Karin Shepardson, World Bank GEF Executive Coordinator		03/15/2012	Ashish Khanna	+91-11-41177899	Akhanna2@worldbank.org