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## United Nations Development Programme

Department of Environment  
Ministry of Environment and Forest  
Government of Bangladesh

### UNDP/GEF Project: Improving Kiln Efficiency in Brick Making Industry (IKEBMI) (GEF PIMS 1901)

### Terminal Evaluation Report

**Mission Member:**

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## SYNOPSIS

**Title of UNDP supported GEF financed project:** Improving Kiln Efficiency in Brick Making Industries

**UNDP Project ID:** 75326

**GEF Project ID:** 1901

**Evaluation time frame:** April 2010 to June 2016

**Date of evaluation report:** September 20, 2016

**Region and Countries included in the project:** Bangladesh

**GEF Focal Area Strategy (GEF-4):** Promoting Energy Efficiency in the Industrial Sector

**Implementing partner and other strategic partners:** UNDP Bangladesh, Clean Energy Alternatives (CEA) Inc. and Xian Institute of Wall & Roof Building Materials

**Evaluation team members:** Mr. Sandeep Tandon, International Consultant.

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## ABBREVIATIONS

Acronym	Meaning
ADB	Asian Development Bank
AWP	Annual Work Plan
BABMA	Bangladesh Auto Brick Manufacturer’s Association
BBMOA	Bangladesh Brick Manufacturing Owners Association
BELA	Bangladesh Environmental Lawyers Association
BMI	Brick Manufacturing Industry
BTK	Bull’s Trench Kiln
BUET	Bangladesh University of Engineering and Technology
CASE	Clean Air Sustainable Environment Project (World Bank Project)
DEX	Directly Executed (project implementation modality)
DoE	Department of Environment (Government of Bangladesh)
EEK	Energy Efficient Kilns
EOP	End of Project
FCK	Fixed Chimney Kiln
FDTK	Forced Draft Tunnel Kiln
GEF	Global Environment Facility
GHG	Greenhouse gases
GoB	Government of Bangladesh
HBRI	Housing and Building Research Institute
HHK	Hybrid Hoffman Kiln
LOA	Letter of Agreement
MDTF	Multi Donor Trust Fund
MoEF	Ministry of Environment & Forests
MTR	Mid Term Review
NOx	Oxides of Nitrogen
PDF-B	Project Development Funds – Block B
PDD	Project design document
PFI	Private Financial Institutions
PMU	Project Management Unit
PPM	Project Planning Matrix
Prodoc	Project Document
PSC	Project Steering Committee
SREDA	Sustainable and Renewable Energy Development Agency
SME	Small and Medium Enterprise
SPM	Suspended Particulate Matter
SOx	Oxides of Sulphur
TAC	Technical Advisory Committee
TE	Terminal Evaluation
TJ	Tera Joules
TOR	Terms of Reference
UNDP	United Nations Development Agency
USD	United States Dollar
VSBK	Vertical Shaft Brick Kiln
WB	World Bank

# EXECUTIVE SUMMARY

## Background

This report summarizes the findings of the Terminal Evaluation Mission conducted during August 8 to 18, 2016 for the GEF-funded project on ‘Improving Kiln Efficiency in Bricking Making Industries’, implemented by UNDP Bangladesh (hereby referred to as ‘IKEBMI’ or ‘the Project’). The project received USD 3 million grant from the Global Environmental Facility (GEF). The Project was developed based on the learning gained from the technology demonstration between 2004 and 2006, which was funded jointly by GEF and private sector partner using Project Development Funds – Block B. This served as a ‘proof of concept’ that demonstrated the technical and economic viability of setting up a Hybrid-Hoffman Kiln (HHK) in Bangladesh as an energy efficient option for producing clay brick using much less coal thereby reducing the greenhouse gas emissions from the brick making units. The 5-year project received GEF approval in September 2009, and began with signing of Project Document between UNDP and Ministry of Environment and Forest (MOEF) on 4<sup>th</sup> April, 2010. The Project implementation aspects were managed by UNDP as a directly executed (DEX) projects.

## Context and Purpose of the Terminal Evaluation

The principal purpose of Terminal Evaluation (TE) is to assess the project results and impacts as required by the UNDP / GEF Monitoring and Evaluation policy. The *Operational Guidance for GEF Agencies in Conducting Terminal Evaluations* requires all full-sized GEF funded projects to evaluate the progress towards the attainment of global environmental objectives, project objectives and outcomes, capture lessons learned and suggest recommendations on major achievements and improvements. Thus, the purpose of TE is to serve as an agent of change and play a critical role in supporting accountability.

As such, the TE will serve to:

- promote accountability and transparency, and to assess and disclose levels of project accomplishments;
- synthesize lessons that may help improve the selection, design and implementation of future GEF activities;
- provide feedback on issues that are recurrent across the portfolio and need attention, and on improvements regarding previously identified issues; and
- contribute to the GEF Evaluation Office databases for aggregation, analysis and reporting on effectiveness of GEF operations in achieving global environmental benefits and on the quality of monitoring and evaluation across the GEF system.

## Brief Description of the Project

Brick making is an important sector in Bangladesh, which serves as the main building material in the country which is devoid of stone aggregates. Brick, therefore, is used in all civil construction work including road, bridges, besides houses and buildings. In the 1980's and 1990's when the country's Gross Domestic Product (GDP) grew at about 4%, the construction industry grew at 5.5%. Annual growth rate of the construction sector in Bangladesh has been around 8.1% to 8.9% in the last decade and this is expected to continue into the future. A decade ago (around 2006) the total brick production in Bangladesh was estimated to be over 8.66 billion bricks annually with an estimated sale value of around USD450 million, almost 1% of Bangladesh's GDP. It is estimated that brick sector employs over 1 million people.

The traditional brick making business in Bangladesh is an informal industry which uses old kiln design and coal as the main fuel. Due to an outdated design and use of fossil fuel, unrestricted concentration of brick kilns in certain regions in the country has given rise to a number of environmental issues. First and foremost an indiscriminate use of fuel wood resulted in a loss of tree cover and Forest resources. In the recent past there has been deterioration in air quality in country's capital Dhaka, followed by increased GHG (CO<sub>2</sub>) emissions and rapid depletion of fertile top-soil rendering it unusable for any agricultural activity. Since brick kilns are located in low-lying lands, which are prone to monsoon floods, the production of brick is confined to dry months between November to April. Thus the entire year's requirement of fired clay bricks for construction is therefore produced during dry season which lasts for six months.

During winter season absence of surface wind currents, cold ground temperature and the topography causes stratification of air which leads to the formation of "inversion layer". This layer, which is close to the ground traps the emissions leading to increase in its concentration in the atmosphere. While the natural phenomenon of air inversion during winter season is common to many places across the world, it becomes prominent throughout the *Indo-Gangetic plane*<sup>1</sup>. Situation in Bangladesh, which has high population density, is exacerbated due to the emissions from roughly 6000+ traditional brick kilns causing serious air pollution in the vicinity particularly during the cold season. The emissions from brick kilns located not too far from the major cities, combines with other sources of pollution and leads to air-quality issues in the rural and urban areas including Dhaka metropolitan region which has an estimated population of 30million.

The brick production units in Bangladesh are described as 'footloose' due to the way they operate and conduct the business, but as whole they constitute what can be best described as a "*semi-formal*" sector<sup>2</sup>. Production is seasonal, confined to the five to six dry months of the year; technology is outdated; labor productivity low; capitalization non-existent, mostly operating on

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<sup>1</sup> The Indo-Gangetic Plain, also known as the Indus-Ganga and the North Indian River Plain, is a 255 million hectares fertile plain encompassing most of northern and eastern India, the eastern parts of Pakistan, and virtually all of Bangladesh.

<sup>2</sup> A *semi-formal sector* in developing economies, lies in between 'formal' and 'informal' economic sectors and is best described as the sector whose activities appear to be governed by formal rules and procedures but are largely, unregulated and unrecorded by the state. - "Semi-formal sector and the Turkish economy": Mehran Kamrava, British Journal of Middle Eastern Studies, May 2004 (<http://www18.gorgetown.edu/data/people/mk556/publication-33108.pdf>)



equity capital; and informal management. Small and medium enterprises (SMEs) dominate the ownership pattern with little or no cooperative or large-scale operations. Most brickfields are on leased land with no permanent sites and fixtures except chimney. The average brickfield employs about 123 skilled and unskilled workers. Apart from 6 to 10 permanent employees, most are employed for only six months during the production season. These seasonal employees, mostly migrant workers from northern part of Bangladesh, are compelled to seek employment elsewhere during the 'off-season', in agriculture and in other casual work.

Prior to 2004, most kilns in Bangladesh, about 95%, were based on the 150-year old Bull's Trench kiln (BTK) technology. In 2004, following a government order to raise smokestacks to 120 feet, BTK's were modified to accommodate taller chimneys and underground piping necessary to divert the flue gas to the fixed chimney. This required extending the width of the base. The taller chimney creates a strong draft, which improves combustion to some extent and enables flue gas to be released at 120 feet, dispersing the emission over a wider area.

Brick manufacturing is a significant contributor to GHGs on the Indian sub-continent, and more broadly, in Asia. The brick industry contributes in three major ways to the problems identified in the Bangladesh Common Country Assessment (CCA)<sup>3</sup> as matters of serious environmental concern: (i) it is a major source of urban and now increasingly rural air pollution; (ii) it contributes to land degradation; and (iii) it is a major cause of deforestation.

During the development of project document in 2007, an assessment was done of the barriers that had contributed to the evolution of the brick making industry (BMI) and its inability to bring about changes, particularly in the way energy is utilized in brick making operations. The barriers identified were :

- Lack of supporting regulations, fiscal incentives and standards to encourage more energy efficient practices and technologies.;
- Little or no governmental activity to assist the brick industry to undertake comprehensive programs to transform the industry and make it less polluting and more profitable. Brick makers have been left to bring in changes on their own which they have failed to do since they are locked into a vicious cycle of a low efficiency/low income trap;
- Lack of knowledge and access to energy efficient technologies that can also lower production costs at the same time. Comprehensive technology dissemination programs that demonstrate the potential economic benefits of energy-efficient technologies were yet to be carried out;
- Lack of access to liquidity to finance modernization of brick making operations. The BMI are considered high-risk due to the seasonal, itinerant nature of their operations and their lack of collateral;

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<sup>3</sup> United Nations Common Country Assessment Report 2000 for Bangladesh

- Lack of capacity in terms of technical and business skills at the enterprise level to bring in even small changes that could have made production more efficient and less polluting;
- Limited experience of commercial lending institutions with SMEs and in particular, brick SMEs. They lack interaction with and understanding of the brick industry;

Thus, the project objective was to remove the barriers that have so far inhibited adoption of cleaner and more efficient kiln technologies and molding techniques by brick makers in Bangladesh. Their removal through a concerted dissemination program was considered an essential “necessary condition” for the reduction in fuel consumption and GHG emissions, and in air pollution.

### Assessment of Project Outcomes and Sustainability

Table A provides a summary of the terminal evaluation of IKEBMI.

#### Evaluation Ratings

<b>1. Monitoring and Evaluation</b>	<b>Rating<sup>4</sup></b>	<b>2. IA &amp; EA Execution</b>	<b>Rating</b>
M&E design at entry	4	Quality of UNDP Implementation	5
M&E Plan Implementation	5	Quality of Execution - Executing Agency	4
Overall quality of M&E	4.5	Overall quality of Implementation / Execution	4.5
<b>3. Assessment of Outcomes</b>		<b>4. Sustainability</b>	<b>Rating<sup>5</sup></b>
Relevance	6	Financial resources	4
Effectiveness	5.5	Socio-political	4
Efficiency	5	Institutional framework and governance	4
Overall Project Outcome Rating	5.5	Environmental	4
		Overall likelihood of sustainability	4

The overall rating of the Project results is satisfactory (S). This is based on the followings:

<sup>4</sup> 6=*Highly Satisfactory (HS)*: The project has no shortcomings in the achievement of its objectives; 5=*Satisfactory (S)*: The project has minor shortcomings in the achievement of its objectives; 4=*Moderately Satisfactory (MS)*: The project has moderate shortcomings in the achievement of its objectives; 3=*Moderately Unsatisfactory (MU)*: The project has significant shortcomings in the achievement of its objectives; 2=*Unsatisfactory (U)* The project has major shortcomings in the achievement of its objectives; 1=*Highly Unsatisfactory (HU)*: The project has severe shortcomings in the achievement of its objectives.

<sup>5</sup> Sustainability is rated as follows: 4 = Likely (L): negligible risks to sustainability; 3 = Moderately Likely (ML): moderate risks to sustainability; 2 = Moderately Unlikely (MU): significant risks to sustainability; and 1 = Unlikely (U): severe risks to sustainability. Overall rating is equivalent to the lowest sustainability ranking score of the 4 dimensions

- The project has built a solid foundation and should be regarded as the fore-runner bringing about the much needed change by introducing modern clean and efficient technique in brick making;
- The project's work received international recognition when it was presented in Rio+20 conference and it managed to receive additional MDTF and UNDP TRAC funds for Technical Assistance. On a conservative side the project has been successful in leveraging nearly 5 times more investment from entrepreneurs and banks as a part of 'co-financing';
- The Department of Environment has acknowledged that 105 entrepreneurs have taken license from them and about 60 kilns are now in production, although this number needs validation since different sources have provided different numbers which greatly differ. Nonetheless, more than expected number of replications has taken place during the life of project. The demonstrations and interventions by the project have directly and also indirectly played a role in inspiring these replications which is acknowledged in the MTR;
- The project has been able to create consensus among the major role players in the brick industry about the possible measures such as creation of a brick centre, certification of brick technologies and products, research and demonstration, which will provide a solid base both at gov't. and private level to mobilize resources to benefit the industry keeping pace with the environmental and energy concerns. Although, most of the expectations were met, the central role of the information management and advisory services were not achieved as the project and the partners were not able to establish the Brick Centre;
- Project made good use of the additional funds it received and implemented GGCA supported "Gender in Focus: Piloting Gender Support on Energy Efficient Brick Kiln" which looked at the gender related matters. The pilot study provided health support to the female workers of HHK demo kilns, provided training to empower the female workers through labour and social rights;
- By the EOP, about 23 HHK based brick units were operating and another 16 HHK units are under various stages of construction. The project has thus, seeded the HHK technology, which also emerges as most suited to address the air-quality issue according to the World Bank study. The project was successful in obtaining additional financial support from sources other than those committed at the time of Prodoc approval. The project received USD 1 million from UNDP TRAC funds and USD 60,000 from Dutch Government and USD 30,000 from Global Gender and Climate Alliance through Multi-Donor Trust Fund. Co-financing from the stakeholders amounted to USD 77.6 million;
- The project put in a great deal of time and effort for awareness creation. The project held a Regional Awareness Campaign at four divisions which attracted community persons and involved school children in the event who were made aware about the environmental effects of the FCK brick kiln and its modern alternatives through audio-visual, docu-drama and distribution of project brochure and other communication materials created massive awareness among the local people. In order to bring the awareness amongst the print media, the project provided fellowship to two regular journalists titled as 'Green Fellow', who worked closely with the project and carried out investigative reporting related to BMI,

the journalist fellow published an article in one of the leading daily newspaper “The Daily Star”. The project activities received good coverage among local TV channels as well as international TV channels such Aljazeera.

The overall Project sustainability rating is likely (L). This is primarily due to:

- Greater awareness about the merits of energy efficiency kilns, HHK in particular compared to other kilns, and willingness to invest in this technology. DOE had granted approval to 105 applications for setting up HHK based brick kilns;
- GoB allocated about 1 crore Taka in the annual budget for promotion of efficient brick;
- Government of Bangladesh and Department of Environment is contemplating amending the 2013 brick manufacturing act to accommodate energy efficient kilns and putting a limit on the emission from brick kiln and provide industry status of brick making units;
- Substantially low level of stack emissions from HHK brick units. The measured pollutant level for Carbon monoxide (CO), Nitrous Oxide (NO<sub>x</sub>), Sulphur Oxide (SO<sub>x</sub>), and Carbon dioxide (CO<sub>2</sub>) were much below the Bangladesh National Standard ECR97. The suspended particulate matters (SPM) emissions level are also measured to be far below the national standard<sup>6</sup>;
- Presence of local firms in Bangladesh who provide technical design inputs for setting up HHK based kilns;
- Presence on continued engagement of other multilateral agencies – The World Bank and the Asian Development Bank to work with Government of Bangladesh to address the environmental issues of air and soil in brick making throughout the country;
- Strong responses from BABMA to adopt EE in brick making as a means of reducing their energy operational costs, and to produce brick which get greater acceptance in the market and civil construction industry due to its superior technical characteristics;
- Availability of a pipeline of USD 34 million to Bangladesh Bank from ADB’s line of credit and willingness of another 52 Private banks and financial institution to provide debt finance for energy efficient kiln, especially HHK;
- By EOP there are over 25 HHK based brick manufacturing units that are commercially operation and another 16 HHK based units are under construction;
- There are at least 11 agencies that are working as private service providers of EE Brick Technology and providing construction support and machinery for HHK;

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<sup>6</sup> A Comprehensive study on the present status of Hybrid Hoffman Kilns in Bangladesh – BUET report, April 2016

## Conclusions

- The design of the IKEBMI Project, its goals and objectives as stated in the PPM were clear, however the project and component level outcomes were ambitious, which led to a revision of PPM within few months of the setting up of project implementing unit. The project design had given greater emphasis towards the technology aspects of energy efficient kiln, since three out of the six components were related to demonstrate and build local capacity to use HHK technology. As a result, towards the later stage, the project was adaptively managed by UNDP to focus on other nontechnical aspects of brick making. This was an important step to bring a balanced view of the sector in the local context by undertaking studies on social, economic and health related aspects associated with brick making which employs semi-skilled and unskilled workforce.
- Project efforts were significant in bringing together key stakeholders – government agencies, brick makers, financial institutions, international development banks, Civil Society Organizations, consulting firms, academia - to raise awareness about energy efficient and environment safe brick making process with year-round operation. It highlighted social, economic and health benefits for work force engaged in ‘EE’ brick kilns which includes about 20% women. This aspect was important in country context, and the project managed to provide all-round inputs for the development of brick making sector.
- While the technology solutions for brick making to reduce energy consumption and stack emissions are straight forward and well understood, their implementation is more complex. This is due to a number of approvals and permits required in setting up a brick making unit, including large area of land (and at slightly higher elevation to avoid getting affected by monsoon floods) and the cost of technology, all of which taken together increases the overall capital required in setting up an energy efficient brick making unit. Delays in obtaining permits effects the entrepreneurs’ ability to achieve financial closure in a definite time period and move ahead with setting up of brick kiln and, start commercial production.
- The IKEBMI Project contributed to the accelerated growth of the energy efficient kilns (EEK) in Bangladesh since 2011:
  - It provided a structured approach to removing barriers to deployment of EEK by focusing GEF resources on raising awareness, supporting the demonstration of energy efficient HHK technology which also created greater awareness about the year-round brick production and improved working conditions. The barriers identified at the start of IKEBMI have been addressed by end of project (EOP). Equipped with experience of EEK operation, government is actively engaged in preparing a roadmap to reduce emissions from brick kilns.
  - The Project generated useful analytical reports, audio-visual materials, provided wide publicity through TV about climate change, air quality issues and comparison

- of traditional brick making process with energy efficient kiln being demonstrate by UNDP. These knowledge products and services helped to raise awareness of EEK systems to a wide range of stakeholders in divisions having large number of brick kilns;
- Due to long lead time in obtaining necessary permits and setting up the brick kilns with higher investment the project had only 5 demonstration projects. However, the successful outcome of PDF-B had motivated a number of entrepreneurs, who took the initiative to invest in HHK. Consequently, at the time of EOP, around 25 HHK were reported to be operational in various parts of the country. Considering, the project started with one HHK brick kiln, the project did very well to introduce HHK as an energy efficient brick manufacturing process which had additional advantage of year-round production of brick, lower coal consumption and therefore reduced emissions of GHG and other pollutants in the chimney (stack).
  - Limited number of demonstration project influenced approximately four times more investment in EEK. Approximately over 25 kiln<sup>7</sup> that were built using HHK technology are operational. These taken together leveraged an estimated investment of approximately USD 77.4 million in HHK based brick production. ADB's USD50m Line of Credit to Bangladesh Bank to provide concessional interest rate debt financing for brick industry to set up EE kilns is a major factor that will ensure that the investments in HHK continue after EOP. The owners of EEK have come together and formed an association known as Bangladesh Auto Brick Manufacturer's Association (BABMA) which is lobbying with the government for the 'industry' status for EEK to create a level playing field with traditional FCK, and encourage investment in EEK.
- IKEBMI Project has done very well to overcome the barriers in the brick sector and achieved most of the project level outcomes by EOP considering the resources available. The project has accelerated growth of the EEK after the launch in 2010 and increased the market share of bricks produced from EEK. The project received co-financing contribution from the entrepreneurs of USD77.5million and has leveraged an additional USD16 million from ADB for setting up EEK for brick making by EOP. Overall, co-financing contribution towards the Project greatly exceeded the original targets.

## Recommendations

Although the IKEBMI project has achieved the overall project goals, the brick sector still requires several round of discussions among stakeholders to arrive at a clear direction on new technology choices for brick production in the future for brick making. This includes taking into consideration the air quality and use of top soil, which is becoming a serious environmental issue, considering

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<sup>7</sup> As reported in BUET report to UNDP, submitted in August 2016.

top-soil is essential for crop production and the country needs to ensure the production levels are maintained or increased to cater to ensure food security of growing population.

There is a need to expedite the revision of technical standards of bricks produced from EEK, and to find alternative materials that are locally available for making bricks and develop technical specification for its application in civil construction. Pilots studies and trial carried out by HBRI are encouraging and need greater attention as well as encouragement for carrying out trials in building using brick made of alternate materials.

High level of pollution contributed by the brick kilns and rapid proliferation of brick kilns were long identified as the main cause of the deteriorating air quality. The project, encouraged by the successful outcome of the project development phase set forth to remove various barriers which prevented introduction of technologies and processes for brick making that are less harmful to the environment. While the IKEBMI project has been able to satisfactorily address the barriers and open the door for HHK and other energy-efficient process, these however, remain at a nascent stage and require to be nurtured to address a bigger cause of GHG emission and particularly to improve the ambient air quality which effects a large population across the country. The following recommendations are reflection on the future course for the promotion of environment friendly brick sector:

**Recommendation 1: UNDP should maintain engagement with brick sector and support government in developing a medium and long-term plan taking into consideration environmental, social and economic factors:** The Department of Environment is considering amending the Brick Manufacturing and Brick Kilns Establishment (Control) Act 2013 which is expected to provide greater clarity on the technology choice to for brick making taking into consideration the environmental factors. Therefore, given UNDP's substantial engagement in the brick sector over the past decade, it is recommended that it continues engagement in the sector to increase the market share of building materials that are environment friendly. UNDP's follow-on program should follow the path to (a) support government's endeavor in finding alternate building materials that are developed using local resources, and use process that are less energy intensive and to (b) develop norms and specifications for using alternate building materials in different types of buildings and amend specification for its use bulk users (government and large builders) to gain public confidence on its use.

**Recommendation 2: The brick making sector should be granted industrial status to bring environmental and social safeguards, and provide better social, economic and health status to the work force.** Higher capital need, larger area requirement and higher capacity of HHK technology compared to the others is a challenge for implementation of given small and medium size brick manufacturing enterprises in Bangladesh. The brick units need to be encouraged to adopt an energy-efficient technology with low-emission, and having access to finance. The government should provide 'industry' status to brick making which can help to regularize them as small or medium size industry from being a semi-formal sector. Due to the nature of activity

of using top soil, the government can regulate it better if it is developed as a formal sector, and licensing, regulation and emission control will become much more manageable.

**Recommendation 3: The system of issuing permits to construct and operate brick-kilns need to follow a fixed time frame and the information should be available to Department of Environment:**

A computerized database mechanism is required to be put in place, which follows a transparent process and a fixed time-frame under which each of the permitting authority grants approval to set up and operate a brick kiln in area under its jurisdiction. This would help the government, particularly DOE, to have accurate information about the total numbers of brick kilns operating in any given year in any division of the country. Also, obtaining permits in a time-bound manner will encourage investment in energy-efficient brick-kiln as the investor will have greater confidence for obtaining financial closure and start construction for commercial production in a definite time frame. Such mechanism will help the regulator (DOE) to plan ahead and factor-in air quality issue and gradually reduce the numbers of conventional brick kilns (FCK) around areas which have high-population or that are environmentally sensitive.

**Recommendation 4: Develop the capacity of Housing and Brick Research Institute to function as technical back stop for the government, financial institution for providing advice on the use of construction material and its sourcing based on environmental sensitivity and local factors.**

HBRI's capacity be built and it should be appointed as the technical back-stop to government, banks and PFI working with Bangladesh Bank using ADB LOC, who need to be sensitized to various brick making technologies and improve their ability for project appraisal / increase lending. HBRI can be entrusted additional responsibility to finetune the technologies sourced from other countries to suit to operating environment / conditions of Bangladesh. It is further suggested that other alternative technologies for brick making, which are being considered should go through following steps before entrepreneurs are invited to invest in it:

- Field trial of the process for at least one year under the varying climatic conditions to understand the variations on product quality and find solutions to address the problem
- Field trial of the product (brick) in different types of building, such as office, commercial buildings, residential, storage facilities (ware house), boundary walls
- Develop specifications and standards for various construction products and notify them through the government process, to make the products acceptable in the market for use
- Provide training and guidance to entrepreneurs on various aspects of brick production which involves the use of different technologies and different production techniques

## Lessons Learned

A concise Project planning matrix (PPM) with identified risks and assumptions is essential for effective project implementation. The IKEBMI project was successful in generating traction with entrepreneurs, Civil Society Organizations, and government officials in division on technical and



social aspects of energy efficient kiln, however, the project design had inherent problems which surfaced much later during the implementation stage.

The project was designed with six components of which three components were focused on the technical aspects of energy efficient kiln technology and remaining three were devoted towards awareness creation, project financing and policy and institutional support. development assistance. During the TE following design issues have been identified in the Prodoc:

- The project design was developed on the lines of a nationally executed project, however due to the requirement of technology development and promotion it was made a directly executed project (DEX) with implementation arrangement involving technology promoters as members of PMU. The CEA and XIAN team were responsible for five components, while UNDP was responsible for implementation of communication and awareness. Thus, there were three different entities involved in executing the project
- Although, CEA and XIAN were awarded work by UNDP through a Letter of Agreement (LOA), however the arrangement had budgetary and operational issues from the beginning, which delayed PMU becoming operational. UNDP signed two separate LOA with CEA and XIAN respectively, however, these two 'Project Cooperation Agreement' defined UNDP's expectations. The description of services broadly defined what is to be done and did not clearly mention the deliverables, timeline of completing various activities and a payment schedule linked to deliverables. This did not provide either UNDP or the Project Board proper control in the execution.
- Many local stakeholders viewed CEA and XIAN as proponent of HHK having commercial interest in the Bangladesh market, and therefore, were not too comfortable in sharing their investment plans and information with the project.
- Steering Committee meeting are critical element of project, which allows engaging high level government officials to provide guidance to the project to overcome the challenges and, also assess the accomplishments made by the project key stakeholders. The project implementation plan included National Steering Committee and Technical Advisory Committee to guide the project, these committees did not meet during the first 3 years, and the project missed out engaging senior level officials from the Ministry of Environment and Forest.
- There is lack of guidance in the Prodoc to formulate strategies to engage stakeholders and soliciting stakeholder feedback to improve and respond to needs. Feedback from stakeholders would have included the difficulties of obtaining permits to setup a brick kiln in a time-bound manner, which is also essential to achieve financial closure with financial institutions leading to construction and commercial production;

In the case of IKEBMI, the mid-term review (MTR) was delayed due to reasons beyond the control of CO. By the time, the MTR report was accepted, the principal implementing partner's (CEA and XIAN) LOA with the project came to an end. The UNDP CO was left to complete several project tasks including the recommendations of MTR. The project did not receive timely advice on the

progress of success indicator to take remedial actions. The Project team had to manage the Project under a PPM with issues detailed in the aforementioned bullet points.

The project benefitted greatly with the involvement of other two major multi-lateral agencies, The World Bank and the Asian Development Bank, both focusing on Bangladesh's brick sector. The World Bank's report on Introducing Clean Technologies in the brick sector corroborates superiority of HHK technology in comparison to other available options on technical, environmental and health benefits. ADB's financial support for establishing EEK, as well as the World Bank's continued engagement in the sector has helped to address the project's sustainability. A formal, periodic meeting between the three agencies for information exchange would have benefitted the project by creating synergies on topics that are of common interest and for progress of respective agencies' work.

The application of energy efficiency principles is slow to be accepted by brick kiln owners due to high capital requirement to migrate from conventional FCK to a high-efficiency HHK. Further, due to lack of standards for superior quality bricks being produced from HHK, the market for improved brick is yet to emerge. Creation of brick standards backed by technical advice of HBRI would help to create a market and increase the share of HHK brick making units in the country which can help to bring tangible improvement in air quality.



# 1. INTRODUCTION

This report summarizes the findings of the Terminal Evaluation Mission conducted during August 8 – 18, 2016 for the Project entitled “Improving Kiln Efficiency in Brick Making Industry” in Bangladesh (hereby referred to as IKEBMI or the Project), that received a USD 3.0 million grant from the Global Environmental Facility (GEF). The project design was carried out in 2006 based on the learning from the PDF-B grant from June 2005 to March, 2007 supported by GEF contribution of USD348,000 and stakeholder costing sharing of USD175,000. The project was designed for USD5million GEF support, which was revised to USD3million at the time of approval in 2006.

## 1.1. Background

In aggregate starved Bangladesh, fired clay bricks form a significant portion of the materials used in the construction industry. They are literally, the major “building-blocks” for all infrastructure projects such as roads, bridges and buildings. Studies conducted in the 1990’s show that out of 14.8 million households, 3.7 million or 25% used bricks as wall materials. Until recently, demand for bricks were mainly urban based, but increasingly its use has spread to rural areas as incomes have risen there. High prices and/or scarcity of alternate building material such as, stones, iron sheets, wood, bamboo, and straw are driving the demand for bricks.

Trend data of the last decade show demand for bricks rising steadily at about 5.28% annually. The main driver of this growth has been the construction industry, which has been growing above GDP rates. In the 1980’s and 1990’s while GDP grew at about 4%, the construction industry grew at 5.5%. Annual growth rate of the construction sector in Bangladesh has ranged from 8.1% to 8.9% in the last decade and this is expected to continue into the foreseeable future. Total brick production in Bangladesh is estimated to be over 8.66 billion bricks annually with an estimated sale value of around USD450 million, almost 1% of Bangladesh’s GDP.

The brick making in Bangladesh is a semi-formal sector. Production is seasonal, confined to the five to six dry months of the year; technology is outdated; labor productivity low; capitalization non-existent, mostly operating on equity capital; and management informal. Small and medium enterprises (SMEs) dominate the ownership pattern with little or no cooperative or large-scale operations. Most brickfields are on leased land with no permanent sites and fixtures. This along with the seasonal nature of production contributes to the footloose nature of the industry. The average brickfield employs about 123 skilled and unskilled workers. Apart from 6 to 10 permanent employees, most are employed for only six months during the production season. These seasonal employees, mostly migrant workers from northern Bangladesh, are compelled to seek employment elsewhere during the ‘off-season’, in agriculture and in other casual work. This contributes, on the one hand, to a precarious employment situation for the worker and, on the other, to the existing low labor productivity.

Brick making in Bangladesh is a highly energy intensive and carbon emitting activity. Prior to 2004, most kilns in Bangladesh, about 95%, were based on the 150-year old Bull's Trench kiln (BTK) technology. As its name implies, the kiln is essentially a trench dug into the ground with a crude structure built over it that serves as an enclosure in which the bricks are burnt. As is to be expected, heat loss to the surrounding air through the kiln walls is excessive and the uncontrolled burning of coal in the kiln creates extreme local and global emissions. In October 2002, following a government rule<sup>8</sup> to raise smokestacks to 120 feet, BTK's were modified to accommodate taller chimneys and underground piping necessary to divert the flue gas to the fixed chimney. This required extending the width of the base. The taller chimney creates a stronger draft, which improves combustion to some extent and enables flue gas to be released at 120 feet, dispersing the pollution over a wider area. This 'new' kiln called the Fixed Chimney Kiln (FCK) is essentially the same Bull's Trench Kiln with a chimney.

Brick manufacturing is a significant contributor to GHGs on the Indian sub-continent, and more broadly, in Asia. This situation will only exacerbate as the pace of urbanization increases and rural incomes rise creating a growing demand for bricks. In some countries, such as China, energy conservation was the driving force behind government interventions to improve kiln technology. This became increasingly critical as brick production expanded which led to significant investments in research and development in kiln technologies to reduce energy usage.

The brick industry contributes in three major ways to the problems identified in the Bangladesh Common Country Assessment (CCA)<sup>9</sup> as matters of serious environmental concern: (i) it is a major source of urban and now increasingly rural air pollution; (ii) it contributes to land degradation; and (iii) it is a significant cause of deforestation. The project was designed to mitigate these negative impacts and contribute to attaining MDG goals and further the efforts to integrate environmental conservation and poverty alleviation strategies contained in the 2003 Poverty Reduction Strategy Paper (PRSP), the Dhaka Declaration and the Declaration of the World Summit on Sustainable Development 2002. It also assists in achieving UNDAF outcomes, specifically UNDAF 4.1 and 4.2. The project was also a strategic focus of the CPAP formulated recently.

In July 2005, the GEF funded PDF B Exercise was initiated. The PDF B Exercise provided the contextual background for the Project by:

- (a) identifying clean technology options;
- (b) conducting a rapid assessment of the possible impact of introducing a mitigating technology;
- (c) identifying potential stakeholders and sensitizing them to the potentials inherent in the proposed mitigating technology;

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<sup>8</sup> Brick Burning Rule (October 2002): The GoB introduced a rule that made the use of 120-foot chimneys for brick kilns compulsory.

<sup>9</sup> Bangladesh United Nations Common Country Assessment Report 2000 Section 3.4.1 on 'Biomass Energy'. CCA 2000 was prepared for the 2001-2005 United Nations Development Assistance Framework.

- (d) developing modalities for training and retraining workers and entrepreneurs to enhance their productive efficiency;
- (e) gauging attitudes of government, financial intermediaries, civil society and brick manufacturers to a transformation program;
- (f) developing baseline estimates of emissions from existing brickfields; and
- (g) identifying potential savings in GHG emissions.

### Barriers to Energy Efficiency in the BMI

The barriers that have contributed to the current state of the BMI and its inability to bring about changes, particularly in the way energy is utilized in brick making operations includes:

Lack of supporting regulations, fiscal incentives and standards to encourage more energy-efficient practices and technologies. Except for some sporadic efforts to regulate the industry, government has made little effort to establish effective boundary limit emission standards;

Little or no governmental activity to assist the brick industry to undertake comprehensive programs to transform the industry and make it less polluting and more profitable. Brick makers have been left to bring in changes on their own which they have failed to do since they are locked into a vicious cycle of a low efficiency/low income trap. A few initiatives that have taken place in the past have come from new entrants and not from traditional brick makers;

Lack of knowledge and access to energy efficient technologies that can also lower production costs at the same time. Comprehensive technology dissemination programs that demonstrate the potential economic benefits of energy-efficient technologies have yet to be carried out;

Lack of access to liquidity to finance modernization of brick making operations. The BMI are considered high-risk due to the seasonal, itinerant nature of their operations and their lack of collateral;

Lack of capacity in terms of technical and business skills at the enterprise level to bring in even small changes that could have made production more efficient and less polluting;

Limited experience of commercial lending institutions with SMEs and in particular, brick SMEs. They lack interaction with and understanding of the brick industry;

### Institutional, Sectoral and Policy Context

Prior to 1989, brick making was an unregulated industry in Bangladesh. Since then the government has introduced some measure of control by legislating the “Brick Burning (Control) Act 1989 (Act #8 of 1989). The main goal of the Act was to eliminate the unrestricted, rampant use of wood fuel in brick kilns. As a first step, it was necessary to bring brick kilns within the purview of the law and greater scrutiny. This was done by introducing registration and permitting requirements. The Act was amended in 1992 and again in 2001. Each amendment sought to tighten the regulations and introduce a greater measure of emissions restrictions. The Act

forbade establishing a kiln within 3 km from an upazila (smallest administrative unit) boundary limit or clusters of homesteads numbering more than 50 homes. It also introduced clauses making the use of firewood in kilns illegal. Enforcement, however, has been lax due to limited numbers of enforcement staff.

Brickfields are also regulated through the Environmental Conservation Rules (1997) which require an Location Clearance Certificate (LCC), Initial Environmental Examination (IEE) and an Environmental Monitoring Plan (EMP) be carried out prior to issue of an environmental clearance from the DoE.

## 1.2. Terminal Evaluation

### 1.2.1. Purpose of the Evaluation

In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support GEF financed projects are required to undergo a Terminal Evaluation (TE) upon completion of implementation of a project to provide a comprehensive and systematic account of the performance of the completed project by evaluating its design, process of implementation and achievements vis-à-vis GEF project objectives and any agreed changes during project implementation. As such, the TE for this Project will serve to:

- promote accountability and transparency, and to assess and disclose levels of project accomplishments;
- synthesize lessons that may help improve the selection, design and implementation of future GEF activities;
- provide feedback on recurrent issues across the portfolio, attention needed, and on improvements regarding previously identified issues;
- contribute to the GEF Evaluation Office databases for aggregation, analysis and reporting on effectiveness of GEF operations in achieving global environmental benefits and on the quality of monitoring and evaluation across the GEF system.

This TE report was prepared to:

- be undertaken independent of project management to ensure independent quality assurance;
- apply UNDP-GEF norms and standards for evaluations;

- assess achievements of outputs and outcomes, likelihood of the sustainability of outcomes; and if the project met the standard M&E requirements;
- report basic data of the evaluation and the project, as well as provide lessons from the Project on broader applicability.

TE mission was carried out in Dhaka from 7<sup>th</sup> August to 17<sup>th</sup> August, 2016. The Terms of Reference (ToRs) for the TE are contained in Appendix A.

Key issues addressed on this TE include:

- Assessing the impact of the entire Project duration from 2004 to the present accounting for the accelerated Project progress since 2009;
- Assessing the roles of the various Project partners including industrial associations and technical institutes;
- Providing recommendations for post-project support to the IKEBMI sector considering the number of brick kilns that appear to be in need of access to energy efficiency options to reduce emissions and comply with the latest directive of Government of Bangladesh.

Outputs from this TE will provide guidance in charting future directions on sustaining energy efficiency initiatives in the brick making sector in Bangladesh.

### 1.2.2. Evaluation Scope and Methodology

The scope of the TE covers the entire GEF-UNDP-CEA-XIAN project on IKEBMI in Bangladesh and its components as well as the co-financed components of the project. The TE will assess the Project implementation taking into account the status of the project activities, outputs and the resource disbursements made up to 30 June 2016. Report on the progress against Objective, each Outcome, Output, Activity (including sub-activities) and Impact Indicators listed in the project document. How far the project has reached on the overall objective and outcome; the timelines and how these will be completed within the project duration.

The TE will be conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects. The project started operations on 6<sup>th</sup> April 2010, after signing of the Project Document.

The TE cover 75 months of the project progress and achievements. The TE follows the approach of using the criteria of **relevance, effectiveness, efficiency, sustainability, and**



**impact**, as defined and explained in the UNDP Guidance for Conducting Terminal Evaluation of UNDP-supported, GEF-financed Projects (2012).

The methodology adopted for this evaluation includes:

- Review of project documentation (i.e. APR/PIRs, meeting minutes of Steering and Advisory Committees) and pertinent background information;
- Interviews with key project personnel including the Project Manager, technical advisors (domestic and international), demonstration project proponents, potential investors and relevant UNDP staff;
- Interview with relevant stakeholders from the Government;
- Field visits to selected project sites and interviews with beneficiaries.

A detailed itinerary of the Mission is shown in Appendix B. A full list of people interviewed and documents reviewed is given in Appendices C and D. The Evaluation Mission for the UNDP-GEF project was comprised of one international expert.

### 1.2.3. Structure of the Evaluation

This evaluation report is presented as follows:

- An overview of project achievements from the commencement of operations in April 2010;
- An assessment of project results based on project objectives and outcomes through relevance, effectiveness and efficiency criteria;
- Assessment of sustainability of Project outcomes;
- Assessment of monitoring and evaluation systems;
- Assessment of progress that affected Project outcomes and sustainability; and
- Lessons learned and recommendations.

This evaluation report is prepared to meet GEF's "Guidelines for GEF Agencies in Conducting Terminal Evaluations, Evaluation Document No. 3" of 2008:

<https://www.thegef.org/gef/sites/thegef.org/files/documents/Policies-TEguidelines7-31.pdf>

The Evaluation also meets conditions set by the UNDP Document entitled "Guidance for Conducting Terminal Evaluation of UNDP-Supported GEF-Financed Projects" <http://web.undp.org/evaluation/documents/guidance/GEF/UNDP-GEF-TE-Guide.pdf>, 2012.

## 2 IKEBMI DESCRIPTION AND DEVELOPMENT CONTEXT

### 2.1 Project Start and Duration

The IKEBMI Project document (ProDoc) was signed on April 04, 2010 with formal Project operations commencing from November with creation of Project Management Unit and having CEA, Inc. and the Xian Institute as executing agency in July, 2010. The project inception workshop was held a year later on March 31, 2011. The ProDoc indicated that IKEBMI was a 5-year project with a Project Terminal date of April 03, 2015. The project was extended once, as per the recommendation provided during the Mid-term review, for 14 months with the terminal date of June 30, 2016.

### 2.2 Problems that the IKEBMI Project Sought to Address

The IKEBMI Project sought to address a number of issues that prevented the introduction of improved technique in the brick making industry, particularly efficient utilization of energy in brick making operation to reduce the pollution level which effects much of the country. The project was built on the success of demonstration carried out in the Project Development Phase between 2004 and 2006. To accelerate the adoption of EcoTech options, the Project was designed to remove multiple barriers, listed below, that effected the brick sector:

- Lack of supporting regulations, fiscal incentives and standards to encourage more energy-efficient practices and technologies. Except for some sporadic efforts to regulate the industry, government has made little effort to establish effective boundary limit emission standards;
- Little or no governmental activity to assist the brick industry to undertake comprehensive programs to transform the industry and make it less polluting and more profitable. Brick makers have been left to bring in changes on their own which they have failed to do since they are locked into a vicious cycle of a low efficiency/low income trap. A few initiatives that have taken place in the past have come from new entrants and not from traditional brick makers;
- Lack of knowledge and access to energy efficient technologies that can also lower production costs at the same time. Comprehensive technology dissemination programs that demonstrate the potential economic benefits of energy-efficient technologies have yet to be carried out;
- Lack of access to liquidity to finance modernization of brick making operations. The BMI are considered high-risk due to the seasonal, itinerant nature of their operations and their lack of collateral;

- Lack of capacity in terms of technical and business skills at the enterprise level to bring in even small changes that could have made production more efficient and less polluting; and
- Limited experience of commercial lending institutions with SMEs and in particular, brick SMEs. They lack interaction with and understanding of the brick industry;

### 2.3 Objectives of the Project

The Project **objective** was the removal of barriers that have so far inhibited adoption of cleaner and more efficient kiln technologies and molding techniques by brick makers in Bangladesh. Their removal through a concerted dissemination program is an essential “necessary condition for any meaningful reduction in GHG emissions and in air pollution.

### 2.4 Main Stakeholders

The main stakeholders of the IKEBMI Project are listed in an approximate order of ownership and involvement:

- Clean Energy Alternatives (CEA): CEA is a Dhaka-based company formed to promote and facilitate widespread use of clean energy and energy efficient alternatives in Bangladesh. CEA has experience in market transformation projects including CNG as alternative transportation fuel under an UNDP project whose outcome was the mainstreaming of CNG in Dhaka City in a commercial way. CEA is the project proponent of brick kiln project and fostered cooperation between a number of technology groups to set-up of the demonstration EEK during PDF-B phase. CEA developed the concepts; sourced and identified the technologies; contracted the technology provider and the technology champion as well as potential commercial financiers and brick entrepreneurs in Bangladesh. CEA contributed in identifying XIAN as a technology provider and BUET as technology arbiters and as such, has fostered cooperation between technology groups to setup the demonstration an energy efficient kiln during the PDF B Phase. CEA was also responsible for the development and application of appropriate baseline methodologies, and developing monitoring plans and capacity to screen and select plants for project selection. CEA will be a Responsible Party in the Full Scale Project.
- Xian Institute of Wall Building Materials (XIAN): The XIAN is a China government institute that is responsible for both research and development of wall materials as well as setting national quality standards. This state-owned research and development institute in China that has developed the Hybrid-Hoffman Kiln (HHK) for use throughout most of China's brick industry. Moreover, XIAN is a part of a larger R&D organization, the China Building Materials Academy (CBMA) dedicated to advancing the quality of building materials and improving the efficiency of their related industrial facilities. Xian provided the technical back stopping support for the first demonstration project in Bangladesh. Their

engineering staffs were responsible for the first constructed and operational HHK in Bangladesh in 2006-7 during the PDF B Phase of the project. XIAN institution has previous working experience with UNDP and GEF funds. Xian Institute will be another Responsible Party in the Full Scale Project.

- Bangladesh Brick Manufacturers Owners Association (BBMOA): They represent the interests of brick manufacturing owners throughout Bangladesh. They have approximately 4,000 members representing about 4,000 operations, roughly 90% of all of these brickfields in Bangladesh.
- Bangladesh University of Engineering and Technology (BUET): They are premier technology learning institution of Bangladesh and viewed as the most respected arbiter of new technology evaluations by the Government of Bangladesh.
- Department of Environment (DoE): DoE is the government agency tasked with ensuring a safe, high quality environment for all Bangladeshis through the prevention and control of pollution and through strategic environmental management for ecosystem protection;
- Ministry of Environment and Forest (MoEF): The MoEF is the parent agency of the DoE with the mandate to formulate policy over matters in the areas of prevention and control of pollution as well as the sustainable use of natural resources;
- Private Sector: Private sector stakeholders include a number of well-managed private sector firms, all of whom represent a new wave of emerging young entrepreneurial professionals keen to re-invest in environmentally-friendly projects.

## 2.5 Expected Results

To achieve the overall goal and objective, the project was designed comprising of six major components to jointly address the problems that prevent widespread adoption of energy efficiency and modern techniques by the brick making industry in Bangladesh. Each of the six components consisted of specific activities designed to address specific set of barriers to achieve the following Project outcomes:

### Component 1 – EEK Technology Support Program:

This component is comprised of activities that will address the technical barriers in the BMI that hinders the widespread applications of EEK technologies. The main outcome of these activities is the thorough understanding and appreciation of technology options and their environmental impacts by brick makers, government and other stakeholders.

#### Activity 1.1: Assessment of Other EC&EE and EEK Technology Options for the BMI - This

activity will involve a more detailed techno-economic evaluation, and all the necessary technical requirements for the successful and effective implementation, of an appropriate EEK and brick making technologies. The project will take initiative to monitor the emissions from the first demo project of HHKs before construction of other plants.

Activity 1.2: Clay Resources Assessment – This activity will involve the review of any available assessments of the country's clay resources. A limited scale survey of potential clay deposits will be carried out to supplement/update existing information. A framework plan for the sustainable utilization of the clay resource will be developed. Existing mapping of clay resources in the country will be updated to reflect new information;

Activity 1.3: Evaluation of the Operating Performance of BMI Companies – This activity is designed to evaluate the present performance of all brick makers in the country. This will provide useful inputs in the design of new brick making facilities or modifications in existing facilities, as well as identify potential improvements in the operation of these facilities;

Activity 1.4: Identification of Potential Improvements in the Energy Performance of the BMI – This will be carried out in conjunction with Activity 1.3. Performance evaluation reports highlighting detailed findings and improvement recommendations will be prepared. The amount of coal use reduction in HHKs will be assessed in the first demonstration kiln and the result will be published for the stakeholders;

Activity 1.5: BMI Energy Reporting and Monitoring (BERM) Program – This will involve the monitoring of the energy performance of the BMI. The periodic reports will be submitted to the BBMOA and SEDA, which will monitor and evaluate the energy performance of each brick maker. Information collected from this BMI energy reporting and monitoring (BERM) program will be stored in the BMI Database of the BMI Information Centre. The BERM program will be designed to become a regular activity of the BBMOA. The program will track the achievement of the target indicators to determine project impacts;

Activity 1.6: Development of a Local BMI Engineering and Consultancy Service Industry - This activity will address the need for an enhanced local expertise in the area of brick making technology that will support the BMI in Bangladesh. It will also include capacity building for local engineering consultants in providing services on EC&EE and EEK technology for the BMI. This industry (i.e., BMI support industry) is expected to develop and provide the technical services associated with the design, installation, and maintenance and troubleshooting of EEKs and brick making equipment and/or components;

Component 2 – EEK Demonstration Program - This component will address the barrier concerning the need to showcase the major aspects of the application of EEKs and energy

efficient brick making practices, and the limited EEK demonstrations in the BMI of Bangladesh. The main outcome of this project component is the establishment of a critical mass of demonstration projects that will provide detailed information of EEK operations, energy savings and environmental impacts to interested brick makers.

Activity 2.1: Promotion of EEK Technology and EC&EE Demonstration Projects – This activity will involve the conduct of a seminar-workshop to promote the demonstration projects, for purposes of identifying the brick makers who are interested in hosting the demonstrations;

Activity 2.2: Conduct of Detailed Feasibility Analyses of Selected Demonstration Sites – The feasibility analyses that were conducted during the PDF-B phase of the project will be reviewed to determine and verify project implementation requirements. If required, further feasibility assessments will be carried out by the demonstration hosts;

Activity 2.3: Specific Demonstration Project Implementation Requirements – This will involve the performance of activities to meet certain requirements required to facilitate the smooth and effective implementation of the demonstration projects. Among these are: (1) Verification and confirmation of the availability and quantity of clay resources; (2) Availability of materials needed and manpower for the construction of the EEKs; and, (3) Financing assistance mechanism for the financing of some of the demo projects. In addition, technical assistance will be provided in the setting up of administration, as well as operation and maintenance systems at the demonstration sites;

Activity 2.4: Establishment of Baseline Data for the Demonstration Project Sites – This activity will involve the conduct of energy consumption and production surveys, as well as socio-economic conditions at the project sites and baseline performance data. Operating performance targets for each demonstration projects will also be established. This activity could be carried out in conjunction with the review/conduct of the feasibility analyses (Activity 2.2). The baseline will be established by the end of the first year of project implementation;

Activity 2.5: Finalized Design of Demonstration Projects – This activity will involve the provision of technical assistance in the preparation of the EEK project, or EC&EE project basic engineering designs, particularly to sites where no previous designs have been proposed. It will also involve provision of technical advice in the comprehensive technical and economic feasibility evaluations, as well as in the detailed engineering designs;

Activity 2.6: Technical Assistance for the Financing of Demonstration Projects – The provision of assistance in the processing of applications for the financing of the operation and maintenance of each demonstration site will form bulk of the work under this activity. Host brick makers that are availing of the financing from banks/financial institutions (B/FIs) will be assisted (if needed) in securing their financing.

### Component 3 – EEK Managerial and Technical Capacity Development Programme

This component has been primarily designed to address the barrier of inadequate technical capacity to support the installation and operation of EEKs and different energy efficient brick making practices that can also lower production costs and emissions. The expected main outcome of this component is improved local vocational, technical; and managerial capacity to manage and sustain operations of EEKs and EE practices in Bangladesh:

Activity 3.1: Technical Capacity Building for BMI Production Personnel – This activity will involve the conduct of comprehensive training courses on EC&EE, EEKs and EE brick making practices and methodologies, development of a certification program for EEK operators. It will be part of a certification process for operators to operate and maintain EEK system equipment and components. These training and certification program are expected to continue even after the completion of the project. This activity will also involve capacity building for the BBMOA to enable it to become a service provider to the industry.

Activity 3.2: Assessment of Capabilities of Existing BMI Maintenance Service Providers - This activity will involve the evaluation of the capabilities of the local engineering firms in performing technical and maintenance services to brick makers. Assessment reports highlighting findings and recommendations will be prepared and submitted to BBMOA, SEDA and DOE.

Activity 3.3: Assessment of the Viability of Local Manufacturing of EEKs and Associated Equipment and/or Components - This activity will involve the evaluation of the feasibility of, and requirements for developing an industry/business for the local manufacture of EEKs and associated equipment and components. Assessment reports highlighting findings and recommendations for local manufacturing of brick making equipment for domestic use (and possibly for the export market) will be prepared and submitted to BBMOA, SEDA and DOE.

Activity 3.4: Feasibility Study on the Standardization of Brick Making Kilns & Associated Equipment and/or Components - This activity will involve the evaluation of the feasibility of, and requirements for, standardizing the procurement/supply/manufacturing of brick making equipment and components. Assessment reports highlighting findings and recommendations for possible mass procurement of brick making equipment and components will be prepared and submitted to BBMOA, SEDA and DOE

Activity 3.5: Training Course on the Design, Feasibility Evaluation, Construction, Operation and Maintenance of EEKs – This capacity building activity will involve the provision of comprehensive training courses on the design, construction, economic feasibility evaluation, operation and maintenance of EEKs for local engineering firms and equipment manufacturers, repair and maintenance service providers and BMI personnel. The training

courses form part of the required capacity building for BBMOA to enable it to become a service provider to the BMI.

Activity 3.6: EC&EE in the BMI Technology Education Program – This will involve the conduct of a training course on EC&EE in the BMI for BBMOA staff, comprehensive training course on modern brick making technology for local engineering firms. The training courses form part of the required capacity building for BBMOA to enable it to become a credible service provider to the BMI. These training courses are expected to be continuously conducted by the BBMOA after the completion of the project.

Activity 3.7: Technical Assistance in Planning BMI EC&EE Projects – This activity will involve provision of assistance to the BBMOA and the brick makers in efforts towards widespread adoption of EC&EE in the BMI beyond the IKEBMI. Project proposals will be prepared for new projects covering project set-up, cost-benefit analysis (e.g., energy saving potentials and GHG emissions reduction) and financial plan.

Component 4 – Communications and Awareness Programme: This component is intended for addressing the barriers related to low awareness of government, public, and SMEs of technical alternatives to energy efficient brick making methodologies and practices, as well as the lack of access to information on EEKs and EC&EE in brick making. The primary outcome of the activities that will be carried out under this component is the enhanced awareness of the public and other stakeholders on EEKs, EE brick making methodologies/practices and energy efficient bricks production.

Activity 4.1: Establishment of a BMI Information Centre – This will involve the establishment of an Information Centre in the BBMOA to cater for the information needs of the BMI SMEs on Energy Conservation & Energy Efficiency (EC&EE), in general, and in energy efficient brick making methodologies/practices, EEKs, and manufacturing of energy efficient bricks, in particular. It will also involve the development and maintenance of a BMI Database, which will contain information about the profiles of the different brick making companies (brick makers) in the country. The Project will also facilitate formation of a core support group of stakeholders, especially developers to support and propagate the use of energy efficient and environmentally friendly technology in brick making and allied fields.

Activity 4.2: EC&EE in the BMI Promotion & Advocacy Program – In line with the information dissemination and awareness raising objectives of the project, this activity is aimed at raising the general awareness of BMI energy performance issues with policy makers, the BMI in Bangladesh and the general public. This outreach and promotion activity will make use of appropriate communication mechanisms that will be designed based on the stakeholder analysis during the PDF-B exercise, and can include consultations, seminars, meetings, publications, case history documentation, video, exhibits and study tours. Special attention will be provided to create awareness for illegal



use of firewood around the Ecologically Critical Areas (ECA) in the country

Activity 4.3: Integrated BMI Information Exchange Service – In order for the Information Centre to keep abreast of developments in EC&EE technology in the brick manufacturing industry, this activity will be implemented to obtain and share information within and from outside the country. The information exchange service will involve publication of a newsletter containing information circulated through the information exchange service (local/ regional), monitoring of all brick makers in the country and preparation and updating of profiles of these facilities, inputting of information materials on brick making technology incorporated in the BMI Database, and abstracting of relevant articles from scientific and engineering journals on brick making technology.

Activity 4.4: BMI Energy Awards Program - This is intended both for information development and as a promotional activity to encourage the BMI companies to improve their energy utilization performance. As part of the promotional campaign, this activity is intended to encourage healthy competition between brick makers to improve energy performance. Using the information gathered from the BERM program, the energy utilization performance of brick maker is evaluated, rated and ranked. The BBMOA, in cooperation with local governments and the BMI support industry will carry out this as an annual activity.

**Component 5: EEK Finance Support Program** - This component has been primarily designed to address the BMI SMEs' lack of access to finance for supporting EEK applications and energy efficiency initiatives. The major activities will include preparation of financing action plan, project feasibility reports, building capacity of banks to service small businesses, linkages with IFI-backed financial agencies and third country visits for the stakeholders. The expected outcome from this component is the availability of financial and institutional support to encourage SME adoption of EEKs.

Activity 5.1: Preparation of Action Plan for Financing BMI SMEs – This will involve the conduct of a study compiling details of all demonstration sites, potential entrepreneurs, market conditions for bricks and possible financing modalities. Based on the study, an action plan will be prepared outlining the essential steps and actions to be taken to facilitate the provision of financing of energy efficiency initiatives and EEK applications for BMI SMEs.;

Activity 5.2: Conduct of Techno-Economic Feasibility Evaluation of BMI SME Financing – This will involve the evaluation of the viability of financing EC&EE initiatives in the BMI SMEs, including the assessment of potential financing schemes. A report detailing the terms and conditions of each viable scheme will be prepared;

Activity 5.3: Capacity Building for Banks/Financial Institutions (B/FIs) – This will involve the conduct of training workshops on evaluating the financial viability of EC&EE projects. The

workshops will also serve as campaigns addressed towards enhancing the B/FIs' interest in providing financing to BMI SMEs. This will also involve securing support from B/FIs in the financing scheme that the project will help develop;

Activity 5.4: Promotion of Business Links – This will involve establishing links between prospective SMEs and commercial banks with IFI-backed financial agencies, through workshops and seminars;

Activity 5.5: Capacity Building on Accessing Financing Sources – This task will involve the conduct of training courses on project financing for the BMI (and other interested SMEs), specifically on how to access and apply for other available financing sources that they can tap to finance their EC&EE initiatives and EEK application projects. In addition to commercial sources of financing, there are excellent possibilities to bundle the demonstration projects and access carbon financing as supplementary financing or extra source of revenue;

**Component 6: EEK Policy Development and Institutional Support Program** - This component is designed to address the policy and regulation related barriers that affect the widespread application of EEK technologies in the BMI. Presently, the environmental regulations in brick making industries are not in conformity with energy efficient brickfields. The expected outcome of the activities that will be carried out is the promulgation of, and compliance to, favourable policies and regulations that encourage adoption of EEKs and energy efficient brick making practices and methodologies.

Activity 6.1: Improvement of GoB Awareness and Commitment to Enforce a Favourable Regulatory Regime for the BMI – This activity will involve campaigns and lobbying activities to get the willingness and commitment of relevant GoB agencies to advance policy reform for the BMI towards EEKs;

Activity 6.2: Formulation of Policies, and Associated Implementing Rules and Regulations (IRRs) – Policy recommendations will be prepared, along with the IRRs. This activity will also serve as part of the capacity building for the GoB in the design and preparation of environmentally sustainable policies, in general, and the same type of policies for the BMI, in particular. The project will support the Department of Environment in making suitable regulations for smooth implementation of energy efficient kilns;

Activity 6.3: Implementation of Policy Support Activities – This will involve conduct of campaigns targeting the relevant GoB agencies to encourage and lobby for the endorsement/approval of the proposed policy recommendations and IRRs. The draft policies and IRRs will be disseminated and presented to all stakeholders in workshops & seminars to also secure their support;

Activity 6.4: Capacity Building on BMI Energy Efficiency Policy/Regulation Enforcement – This will involve the conduct of 3 annual national enforcement workshops to enhance capacity and skills of relevant GoB agencies and the BMI in the enforcement of, and compliance to, EE-related policies/regulations as applied to the BMI;

Activity 6.5: Formulation and Implementation of Strategies to Minimize Land Degradation from Brick Making Activities – This will involve the conduct of studies and workshops on environmentally sustainable clay mining practices. A rapid assessment of the impacts on land degradation of the current practices and sources of clay mining will be carried out. Success in this effort may have collateral benefits in flood control efforts since silting of riverbeds is a major concern in Bangladesh;

Activity 6.6: Review of the BMI Energy Efficiency Policy – This activity will involve the review and evaluation of the BMI energy efficiency policy based on the results of the demonstration program (Component 2). Revised policy and implementing guidelines will be formulated and recommended for issuance and enforcement;

Activity 6.7: Capacity Building on EEKs and Compliance with Emission Standards – This will involve capacity building activities for BBMOA on the adoption, operation and maintenance of EEKs as a means to comply with cleaner emission standards as set by DoE. This will be carried out through regional workshops on emission standards compliance, EEK operation and maintenance, and EE practices in the BMI, as well as in the CO<sub>2</sub> emissions monitoring in the demonstration projects.

*Details of the accomplishment of IKEBMI are provided in the next section.*

## 3 FINDINGS

### 3.1 PROJECT DESIGN AND FORMULATION

#### 3.1.1 Analysis of Project-Planning Matrix / Results Framework

The Project-planning matrix (PPM) that has been reviewed for this Project is contained in Appendix G. The original PPM was prepared in 2006 during the design of full-sized project taking into consideration the demonstration experience gained from PDF-B project, which supported pilot demonstration of HHK for brick making. The PPM for this Project, understandable in its intent, was inclined towards establishing an ecosystem to promote cleaner and energy efficient technology in brick making. In order to build the momentum and create local capacity to design, install and operate HHK technology based brick kiln, the project had three outcomes, out of a total six, focused towards building capacity among stakeholders to own and operate HHK brick kilns. The original project design, especially the PPM had many outputs that had ambitious targets and the overall PPM was problematic in that there were too many outcomes that together aimed at promoting a technology rather than engaging the brick sector stakeholders and motivate them to adopt EE interventions.

#### 3.1.2 Assumptions and Risks

While most of the assumptions and risks provided in the PPM are reasonable in the realm of risk assessments of IKEBMI, there are two additional assumptions that should have been included:

- “Delay in obtaining permits to set-up EEK” which has affected the project in reaching its target timely, which continues to affect several entrepreneurs who have to face inordinate delays to acquire all the necessary permits to be eligible for the bank loan which is backed by ADB LoC. One of the prime factor for the delay is the complexity of land acquisition and procurement process. The Brick Burning Regulation Act stipulates that brick kilns cannot be set up within 3 km of a sub-district or district centre, municipal areas, residential areas, gardens, and the government’s reserve forests. The land requirement for HHK is significantly more than the conventional FCK, moreover for year-round operations it needs to be located in land which is slightly higher elevation to avoid getting submerged during monsoon floods. Such lands are relatively scares.;
- “Political Risk” which takes into consideration emergence of situation where the concept or technology being demonstrated falls out-of-favour due to changes in policies and priority arising from social, economic and environmental development which may lead to the questioning of the project activities and setting up of regulatory barriers which would make the investment in EEK financially unattractive.

### 3.1.3 Lessons from Other Relevant Projects Incorporated into IKEBMI Design

According to the ProDoc, the IKEBMI Project was developed from the successful demonstration of Hybrid Hoffman Kiln at 'Universal Autobricks Limited' under the PDF-B project supported by GEF and other private stakeholders. The project is one of its kind in Bangladesh at the time of signing of Prodoc between Government of Bangladesh and the UNDP Country Office. The lessons learned in PDF-B were incorporated in the IKEBMI design. Apart from the PDF-B activity there has been no prior projects or programmes that provide design or implementation inputs to IKEBMI project to address energy efficiency and climate change linkages in the brick sector.

### 3.1.4 Planned Stakeholder Participation

IKEBMI's planned stakeholder participation was built on the experience gained during PDF-B exercise and included key stakeholders from policy makers, regulators to end-users. All of these stakeholders were represented during the June 2010 Inception consultation workshop, where they shared their experiences, perceptions and opinions on the accelerated development of the sector. The DoE, MoEF and Brick Manufacturers Association interacted with the Project to develop new set of rules which formed a part of "Brick Manufacturing and Brick Kiln Setting up (Control) Act, 2013" (2013 Act).

The stakeholder participation continued in various activities of the project creating synergies with IKEBMI. As the project worked towards its one of its prime goal of reducing the barriers, more stakeholders' were involved in taking a holistic view of the brick making operation and provided insights on 'Occupational Health and Safety, and Gender', Socio-Economic Baseline Study', and review of the 2013 Act. Stakeholder participation widened and continued throughout the project and can be highlighted as another major factor which contributed to local capacity building and increasing the general understanding about the brick making and issues that need to be addressed all of which supports project's sustainability.

### 3.1.5 Replication Approach

Replication can be considered when lessons and experiences are replicated in different geographic areas, and also when lessons and experiences are replicated within the same area but funded by other sources.

The project was designed with components and activities to remove the barriers to EEK and build the local capacity to support the replication. The following components have collectively contributed to the replication already achieved by EOP:

- EEK Technology Support program,
- EEK Demonstration program

- EEK technical and management capacity development program
- Communication and Awareness program
- Financing support program

The cumulative effect has been transfer of knowledge, greater awareness about the energy and environmental benefits of energy efficient kilns. Already, the project has leveraged investment by entrepreneurs and bank finance of approximately USD72million. Additional USD50million from ADB will be available in 2016 and 2017 as debt finance for energy-efficient kilns that would use HHK technology.

### **3.1.6 UNDP Comparative Advantage**

Climate change, environmental protection and disaster risk reduction are critical areas of concern for Bangladesh. As a GEF implementing agency, UNDP has an ongoing relationship through current and UNDP programmes which has helped to establish strong working relationships which are building local capacity to scale up wider adaptation and mitigation efforts in line with the Bangladesh Climate Change Strategy and Action Plan. The IKEBMI objective and outcome is aligned with the current Country Program<sup>10</sup> in which UNDP will focus on building climate and environmental governance capacity at the national and local levels while at the same time support Bangladesh's policy objective to promote low emission growth, the spread of green technologies, and affordable energy access for the poor.

### **3.1.7 Linkages between the IKEBMI Project and Other Interventions within the Sector**

In addition to IKEBMI, The World Bank is also assisting Government of Bangladesh under its "Clean Air and Sustainable Environment" project with detailed comparative analysis of various brick making techniques. Through the project, it has also carried out technology demonstration of Vertical Shaft Brick and Improved Zig-zag kiln, to build local capacity to adopt designs which have significantly reduced emission level. In 2012, Asian Development Bank has signed a loan agreement with the Department of Environment under the Government of Bangladesh to 'Finance Brick Kiln Efficiency Improvement' which includes a USD750,000 technical assistance component for "Supporting Brick Sector Development Program".

Though there are no direct inter-linkages between these projects, each would have derived benefit from the work done by the other, especially IKEBMI which has longer history and working relationship. The brick sector offers unique collaborating opportunity

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<sup>10</sup> Country Programme for Bangladesh 2012-2016 - (Under Outcome 3.2) UNDP continues to focus on developing the capacity of the Government to mainstream the climate-environment poverty nexus into policy and planning frameworks across ministries, while augmenting community-based risk reduction and adaptation capacities.

to the three multi-lateral agencies and benefit from the learning to arrive at a consensus and collaborate with the government to take a holistic view of the brick sector while making technology shift which has become imperative due to air quality issues at country level and to reduce the GHG emission at the national level to address the global concern of climate change.

### 3.1.8 Management Arrangements

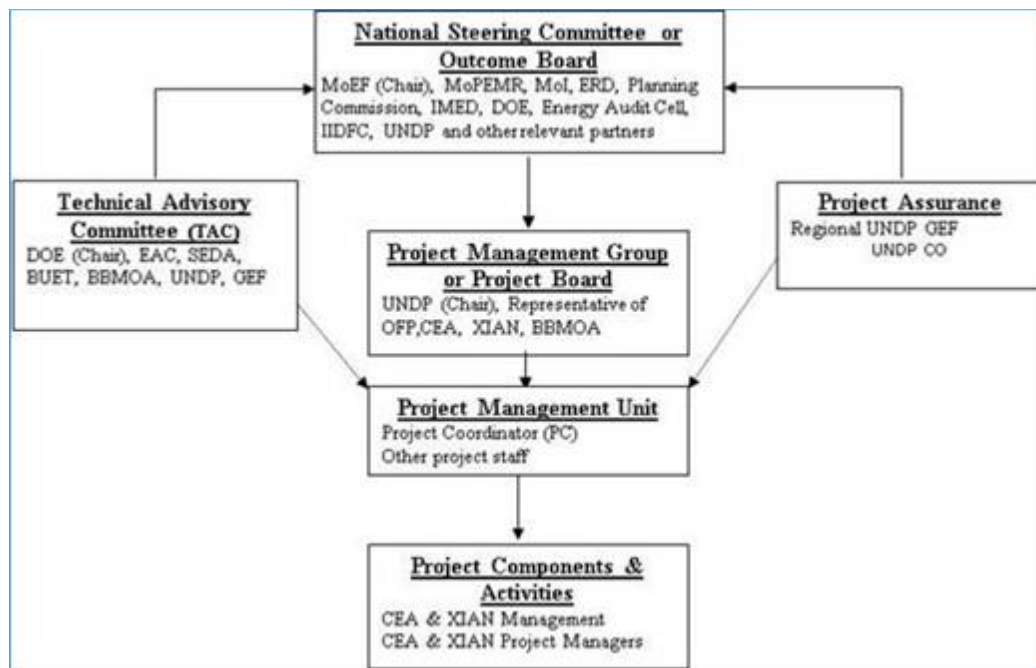
The Project was designed as a Directly Executed project of UNDP with a unique management arrangement in which it was directly implemented by the private sector under the overall framework of the Country Programme Action Plan (CPAP) and following UNDP rules, regulations, procedures and guidelines. UNDP supported the private sector firms (identified as Responsible Party) to manage and coordinate the project through establishment of a Project Management Unit (PMU) which was headed by a Project Coordinator (PC). The Project Coordinator was responsible to UNDP for the achievement of the project objectives, for project reporting, including the submission of work plans and financial reports as per UNDP programme-financial system requirements.

The IKEBMI engaged Clean Energy Alternative (CEA) Inc. and Xian Institute of Wall and Roof Building Materials (Xian Institute) as the two Responsible Parties to implement the project. CEA played a major role in conducting technical trainings, manual development, capacity development of financial institutions, facilitating the financial institutions to ensure project financing, feasibility studies including baseline data, business plan preparation. Xian Institute, as the technology provider, played a major role in detailed designing of different plants, construction supervision, operational guidance to the plants and on-job training to technical staffs in close liaison with CEA. Both, CEA and Xian Institute were engaged by UNDP through a Letter of Agreement (LOA).

An organogram of IKEBMI Project implementation arrangements is provided in Figure 2.

The National Steering Committee (NSC) was established to guide and supervise the project implementation, facilitating inter-ministerial coordination and cooperation with various government agencies. The Steering committee was set up with Secretary, Ministry of Environment & Forest as the chair. The NSC was setup as an inter-ministerial body with representatives from six ministries, namely, Ministry of Power, Energy & Mineral Resources (Energy Division), Ministry of Environment & Forests, Ministry of Industries, Ministry of Finance (ERD), Planning Commission, Implementation Monitoring & Evaluation Division (IMED), Department of Environment, Energy Audit Cell, representatives from UNDP and GEF. The NSC was the formal forum for key stakeholders to discuss the progress of the project.

**Figure 2: IKEBMI Project Implementation Arrangements**



A Technical Advisory Committee (TAC) was established with Department of Environment as chair. TAC membership comprised of representatives from DOE, Energy Audit Cell (EAC), Sustainable and Renewable Energy Development Agency (SREDA), Bangladesh University of Engineering and Technology (BUET), Bangladesh Brick Manufacturers & Owners Association (BBMOA), UNDP and GEF to study the emissions data and to provide technical advice related to the technology to CEA, XIAN. The TAC was expected to meet at least twice every year.

UNDP, as the Executing Agency, had the responsibility to provide operational guidance to the project and quarterly review and approval of work plan and budget. In order to facilitate the implementing partners in running the project, UNDP will chair a much smaller and more functional Project Management Group (Project Board), in a participatory approach, with inclusion of the key implementing partners and the beneficiaries. The Project Board was created to provide UNDP oversight on the progress of the project and provide guidance to the project management.



## 3.2 PROJECT IMPLEMENTATION

Since inception of the project in April 2010, the project had made some remarkable progress during the first three years of its operation. The trend of progress (in terms of tangible accomplishments and budget spending) started becoming slower from the later part of 2013 in connection to non-stop political turmoil throughout the year and beyond. It had direct impact on the Brick Making Industry and subsequently on the GREEN Brick project implementation. In terms of deliverables the project could not do as much as expected. Other than the external factors, some issues came in front when the first MTR was conducted during 2013 and early 2014. Subsequently, the contract with the technical partners had not been renewed after the expiry of their tenure of contract in mid-2014. As per recommendations of the 2nd stage MTR the project made some modifications in its mode of operation and diverted its focus from demonstration to soft activities. In the interim period the project had to cope with changes in its staffing and leadership.

From project implementation perspective, during the reporting period, no major external factor, other than political turmoil during early 2015 had affected project progress. In spite of a relatively slower progress, in connection to the internal factors (e.g. work with technical partners) as discussed earlier, the project became successful in retaining its good relationship with most of the brick making industry (BMI) stakeholders [e.g. Bangladesh Brick Manufacturing Owners Association (BBMOA)].

Since the start, the IKEBMI project needed to be continually adaptive in its management. Much of the focus, in the changing situations, had to be given on monitoring of activities and oversight of resources to achieve the targets and ensure effectiveness.

### 3.2.1 Adaptive Management

Since the commencement of the project in April 2010, it had to adapt to changing circumstances resulting in a number of adaptive management measures being undertaken by the PIU and UNDP CO. Beginning in April 2010 the implementation of IKEBMI could be broadly divided into three phases:

- The first phase in 2010 lasted for about one year in which much of the effort went into setting up of Project Management Unit, which was jointly managed by CEA and Xian – the two parties which were engaged by UNDP CO through a Letter of Association. Other activities included resolving the scope and budgeting issues between UNDP, CEA and Xian, and revising the PPM for project targets. The preparatory phase ended with a Project Inception Workshop on 31<sup>st</sup> March 2011, which marked the start of the project;

- The second phase starting in April 2011 is the period when project began functioning as a DEX modality which lasted until December 2014 and followed all the GEF reporting requirements;
- The third phase in 2015 until EOP is the final phase identified with the disassociation of UNDP with CEA and Xian as their contract came to an end in 2014. The effort of project implementation and following the recommendations of the mid-term review (October 2014) were with the UNDP project team. Since the beginning in 2010, the project saw high turnover of Programme Manager in UNDP CO, which to a small extent slowed down the implementation.

Most of the adaptive management decisions were made at Project Board meetings where Project implementation issues were discussed, and action taken to address the outcome of implementation. Some examples of adaptive management on IKEBMI include:

- The following adaptive management measures were taken in fiscal year 2013: As there were a lot of political turmoil in Bangladesh during the first quarter in that year, the PMU adapted the Business Continuity Plan to keep up with the targets set for the year.
- The project received USD 1 million for scaling up the project target. One of the main objectives of the scale up program is to establish a “Brick Centre” in Bangladesh. To achieve the target, the project took action to recruit a Consultant to prepare the Business Plan.
- The project while implementing its activities, adaptively managed to utilize the additional funds of USD 60,000 it received from Global Gender and Climate Alliance and carried out a study on “Mitigation in Brick Making Industries in Bangladesh: How Gender Matters” to identify the role of women and the present scenario of female workers in brick making industries. The findings of the study were used by the project as a tool for advocating gender issues in the government’s policy interventions.

### **3.2.2 Partnership Arrangements**

IKEBMI project fostered a number of strategic partnership arrangements with several of the stakeholders mentioned below.

- Bangladesh Environmental Lawyer’s Association
- Bangladesh University of Engineering Technology
- Centre for Natural Resource Studies
- Various Civil Society Organizations which worked with the project on awareness campaign in divisions

- Participatory Management Initiative for Development (PMID)
- Bangladesh Auto Brick Manufacturers Association
- Individual consultants

The relationships helped to widen and spread across the subject of brick making, and involved a variety of professionals and local consultants, financial institutions, academic institute and brick producers who carried out studies and provided useful insight on the social, economic and occupational health aspects of the workers associated with brick making sector. This has greatly helped to build a better understanding of the issues with conventional brick kilns and advantages of efficient brick kilns. The project has brought together a number of important players who will be active in continuing and expanding the base of energy-efficient brick kilns after the end of project.

### **3.2.3 Feedback from M&E Activities Used for Adaptive Management**

The Evaluator had access to meeting notes of Project Board meeting, TAC and PSC meetings. The TAC and PSC meeting took place in 2014 however regular meetings of Project Board took place in January 2011 up until June 2016. There is evidence that M&E activities were discussed at PSC meetings and used as the primary means of adaptively managing IKEBMI and to overcome technical and administrative problems. Over 5-year of GEF support to the project, one PSC, two TAC and 10 Project Board meetings were held providing management inputs. Issues were raised in various projects reports such as PIRs, APRs, mid-term review and were discussed during these meetings and acted upon.

### **3.2.4 Project Finance**

A summary of the IKEBMI Project expenditures is provided on Table 1. The expenditures provided to the Evaluation Team were from UNDP's "Combined Delivery Reports" (CDRs), covering the entire duration of the project from its start in 2010 until completion in June 2016.

GEF Project expenditure as of June, 2016 was USD 2,901,284 or 97% of the GEF allocation of USD 3 million. Co-financing from the stakeholders amounted to USD 77.6 million. IKEBMI co-financing details are presented in Table 3. The project was successful in obtaining additional financial support from sources other than those committed at the time of Prodoc approval. The project received USD1 million from UNDP TRAC funds and USD 60,000 from Dutch Government and USD30,000 from Global Gender and Climate Alliance through Multi-Donor Trust Fund. The additional funds were committed and utilised for complementary activities in the brick sector on studies to identify the role of women and the present scenario of female workers in brick making industries, and for scaling up the project target which includes conducting preparatory studies to establish a "Brick Centre" in Bangladesh.

The actual in-kind support from the two Responsible Parties, namely CEA, Inc. and Xian institute could not be obtained since these two were no longer associated with UNDP and the IKEBMI project after the LOA came to an end in 2014.

On the positive side during the life of IKEBMI project, the Xian was successful in securing private sector and bank finance of USD 12.86million in setting up 12 HHK brick kiln. In addition, there are several brick kilns which were setup after the project start. Though these were not directly guided by the responsible parties, however, these brick making units had invested in HHK technology, which implies that the entrepreneurs and banks benefitted from knowledge shared by the IKEBMI project through media campaign, study tours, demonstration projects and workshops. Out a list of 25 operating HHK based BMI, 22 brick kilns have invested about USD 77.4million for which the banks provided USD 27.6 million while the owner's equity contribution was about USD 49.8 million. The evaluator view this as a testimony to project's success in leveraging co-financing and an important function of the project to catalyse the market.

**Table 2: GEF Project Budget Expenditure for 2010-2016 (in USD)**

Outcome	2010	2011	2012	2013	2014	2015	2016	Total Expenditure	Budget	% Utilized
Outcome 1: EEK Technology Support Program	50,000	113,719	95,290	83,498	-	23,605	96,574	462,686	450,519	103%
Outcome 2: EEK Demonstration Program	150,000	244,677	255,198	134,878	-	(1,759)	-	782,994	1,107,680	71%
Outcome 3: EEK Technical and Management Capacity Building Program	100,000	131,765	98,019	80,364	-	-	76,803	486,951	564,546	86%
Outcome 4: Communication and Awareness Program	-	34,309	70,916	28,229	6,787	(2,133)	-	138,108	75,000	184%
Outcome 5: EEK finance Support Program	-	82,281	74,920	26,829	-	-	2	184,032	255,906	72%
Outcome 6: EEK Policy development and institutional support program	154,152	17,475	48,279	927	-	22,047	26,322	269,202	161,996	166%
Outcome 7: Monitoring and Evaluation	1,380	28,286	32,757	19,109	17,915	-	-	99,447	139,310	71%
Outcome 8: Project Management	16,007	107,600	84,507	82,553	17,305	87,142	48,368	443,482	245,043	181%
<b>Total (Actual)</b>	<b>471,539</b>	<b>760,112</b>	<b>759,886</b>	<b>456,387</b>	<b>42,007</b>	<b>128,902</b>	<b>248,069</b>	<b>2,866,901</b>	<b>3,000,000</b>	<b>96%</b>
Total (Cumulative Actual)	471,539	1,231,651	1,991,537	2,447,924	2,489,931	2,618,833	2,866,901	All figures are in US Dollar Overall disbursement till		
Annual Planned Disbursement	538,340	831,901	790,491	471,630	29,409	179,723	374,077			
% Spent - Actual vs Planned Disbursement	88%	91%	96%	97%	143%	72%	66%	June 2016	96%	96%

**Table 3: Commitment, expenditure, balance by different donors for IKEBMI Project**

Co-financing (type/source)	GEF financing		UNDP TRAC funds		Partner Agency (PFI,MDTF Dutch and GGCA <sup>11</sup> )		Total	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Grants	3,000,000	2,866,901	-	265,000	-	90,000	3,000,000	3,221,901
Loans/Concessions (Financial Institution)	-	-	-	-	10,850,000	27,600,000	10,850,000	27,600,000
In-kind support								
Others:								
• CEA	-	-	-	-	80,000	-	80,000	-
• XIAN	-	-	-	-	50,000	-	50,000	-
• Others (entrepreneurs)	-	-	-	-	140,000	49,800,000	140,000	49,800,000
<b>Totals</b>	<b>3,000,000</b>	<b>2,901,000</b>	<b>1,000,000</b>	<b>265,000</b>	<b>11,120,000</b>	<b>77,400,000</b>	<b>15,150,000</b>	<b>80,621,901</b>

<sup>11</sup> MDTF (Dutch Government funds) of USD 30,000 were received for preparing ‘Green Economy Action Plan’, and USD 60,000 from Global Gender and Climate Alliance (GGCA) to carry out a study to identify the role of women and the scenario of female workers in brick making industries

### 3.2.5 M&E Design at Entry and Implementation

Ratings of the Project's Monitoring and Evaluation system<sup>12</sup> are as follows:

- M&E design at entry – 4;
- M&E plan implementation – 5;
- Overall quality of M&E – 4.5.

The design of the Project's M&E activities was moderately satisfactory based on the PPM design containing several indicators that had ambitious target and which had to be revised at the project inception workshop.

As such, it was rather straightforward to quantify the effectiveness of the project outcomes since the targets and indicators in the results framework were quite clear. More importantly, the vast and rapidly growing brick making business has shown a shift in making investment into brick kiln based on energy efficiency production technologies which provide higher productivity, improved working conditions, minimal emissions and year-round operation. This achievement through lowering of the technical barriers provides a good indicator that the Project's M&E activities were effective in improving the capacity of banks and entrepreneurs involved in the brick sector.

The implementation of the M&E plan was satisfactory based on the review of PIRs. The project was monitored through the following M&E activities starting with an Inception Workshop and Report in June 2010:

- Project Implementation reports
- Annual progress reports
- Annual meetings of the Project Board
- Field visits by the UNDP PO
- Project review by UNDP GEF RTA
- Mid-term evaluation
- Terminal evaluation

Regular monitoring and evaluation of the project activities have helped it to stay on course and budget while being able to accomplish the targets. The ratings provided to the project in PIR remained consistent with the ratings provided in the terminal evaluation.

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<sup>12</sup> 6 = HS or Highly Satisfactory: There were no shortcomings;

5 = S or Satisfactory: There were minor shortcomings,

4 = MS or Moderately Satisfactory: There were moderate shortcomings;

3 = MU or Moderately Unsatisfactory: There were significant shortcomings;

2 = U or Unsatisfactory: There were major shortcomings;

1 = HU or Highly Unsatisfactory.

### 3.2.6 UNDP and Executing Partner Performance

Ratings of UNDP (Implementing Agency) and the CEA, Xian (Executing Agency) performance<sup>13</sup> are as follows:

- Quality of UNDP Implementation – 5;
  - Quality of Execution – CEA, XIAN – 4;
  - Overall Quality of Implementation/Execution – 4.5
- 
- The moderately Satisfactory rating is based on the evidence provided by the Project Board meeting minutes on the discussions and approval for actions by DoE and UNDP officers. The other reports which provided feedback on quality of execution were the mid-term review and Project Implementation Reports (PIR) for 2011 through 2016. There was no PIR that provides a record of activities carried out and accomplishments for the first year of the project (2010), as the initial year was devoted to setting up of project implementing unit and staff hiring therefore this does not impact overall quality of project execution, as the required corrective actions were taken and recorded in the inception report and subsequent PIR.
  - The project held regular Project Board meetings which were used to guide, facilitate and review the PMU activities. The Project Board consisted of representatives from UNDP, GEF-OFP, CEA, XIAN and BBMOA. Similarly, the project functioning and management structure had suggested formation of National Steering Committee to serve as high-level inter-ministerial body to be chaired by MOEF, having representatives from three other ministries. Similarly, a Technical Advisory Committee was suggested to serve as resource to the project Board. However, during the entire 5-year period of the project there were one Steering Committee and two Technical Advisory Committee meetings were held while 10 meetings of Project board. The steering committee meeting was held in 2014, and two TAC meetings were also held in 2014, four years after the signing of the Project document, indicates serious oversight on the part of the project implementing unit.
  - UNDP noted that the performance of the implementing partner was not managing the project in a proper way, therefore after the completion of mid-term review, a board meeting was held wherein a revised work plan until 31<sup>st</sup> December 2015 was agreed. During the board meeting it was also agreed to not renew the contracts of CEA, Inc and Xian due to performance issue. As a consequence, UNDP had to manage the project from middle of 2014 till the time of terminal evaluation. Certain activities thus did not reach conclusion especially the work on 'Brick Centre' although a lot of preparatory work went into carrying out various studies on the structure of Brick Center, its service areas, stakeholder consultations, and preparation of business plan. However, the outcome of the studies apparently did not make it to the Project Board

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<sup>13</sup> Ibid 33



- level for further discussion. Furthermore, since the creation of such a centre, which would function after the EOP, requires serious discussion for its acceptance and financial commitment from the highest level from the counterpart government organization. As mentioned earlier, since the project saw only one Steering committee meeting, the agenda of setting up the Brick Centre did not move beyond the studies and therefore did not progress to the next step.
- The project implementing arrangements in which two entities CEA Inc and Xian, which were entrusted the responsibilities of five components while the sixth component, namely, communication remained with UNDP. It has been experience in other GEF project where the PMU consisted of two private sector entities, that the implementation is driven by the commercial interest of the involved entities and remains sub-optimal especially in terms of the overall efficiency and quality of execution. This factor needs to be considered while designing new projects. A PMU with dedicated team supported by subject experts and consulting firms yield better results as noted from various project across the countries.

### 3.3 PROJECT RESULTS

Assessment of the IKEBMI Project achievements and shortcomings are provided in this section against the 2004 Project planning matrix. The outcomes and indicators of the 2004 log-frame were re-written as reflected in the revised project planning matrix included in Annex G. The outcomes and indicators from the 2015 PIR have been used in the assessment of actual project outcomes. Each outcome was evaluated against individual criterion of:

- *Relevance* – the extent to which the outcome is suited to local and national development priorities and organizational policies, including changes over time;
- *Effectiveness* – the extent to which an objective was achieved or how likely it is to be achieved;
- *Efficiency* – the extent to which results were delivered with the least costly resources possible.

The Project outcomes have been rated based on the following scale:

- *6: Highly Satisfactory (HS)*: The project has no shortcomings in the achievement of its objectives;
- *5: Satisfactory (S)*: The project has minor shortcomings in the achievement of its objectives;
- *4: Moderately Satisfactory (MS)*: The project has moderate shortcomings in the achievement of its objectives;
- *3: Moderately Unsatisfactory (MU)*: The project has significant shortcomings in the achievement of its objectives;
- *2: Unsatisfactory (U)*: The project has major shortcomings in the achievement of its objectives;
- *1: Highly Unsatisfactory (HU)*: The project has severe shortcomings in the achievement of its objectives.

#### 3.3.1 Overall Results

Project Goal: To reduce the growth of GHG emissions from the Brick Making Industry in Bangladesh.

Project Objective: Remove the barriers that hinder adoption of cleaner and more efficient kiln and moulding process by Brick Making Industry (BMI)

**Intended EOP Outcome:**

- GHG emissions reduced by 314 kilo-tonnes CO<sub>2</sub> (direct) from 16 EEK demonstration
- Cumulative energy savings from brick kilns by about 3326 TJ or 130 kilo-tonnes coal
- About 2.2% of the bricks produced in Bangladesh are from EEK
- Average energy cost per unit brick in the BMI is reduced by 1.2%

**Actual EOP Outcome:**

- *A satisfactory outcome has been achieved with the adoption of Energy-efficient (EE) Hybrid-Hoffman Kiln by more than 35 of the BMI against the project target of 16 BMIs in Bangladesh<sup>14</sup>. The project has carried out awareness campaign which sensitized government officials in division, CSO, academia and financial institution about the environmental benefits improved kilns in reducing the GHG and improving the air quality. The project has leveraged an estimated USD77million investment in HHK based brick kilns. The project has indirectly influenced ADB's USD50 million line of credit to Bangladesh Bank, which was approved in May 2012 by the ADB board for lending to brick making industry to setup energy efficient brick kilns. At the time of TE mission, and four years after the approval ADB has disbursed USD16 million to Bangladesh Bank and second disbursement of USD10million was in the pipeline. At present, the prime reason for the delay in setting up an auto brick unit is due to the delay in obtaining environmental clearance certificate from the DoE, which delays the investment.*
- *The project had strong emphasis on awareness creation and advocacy in which 69 media reports were published including 49 news stories were published in print media, more than 20 news reports were aired in electronic media. The project provided support to the government in drafting a set of policy on Implementing Rules and Regulation for brick kiln which included technologies, raw materials, finished products, land use and emission standards. Projects also provided recommendation on Bangladesh Brick Manufacturing (control) Act, 2013, and drafted brick quality standard;*
- *A satisfactory outcome has been achieved in the reporting of the energy performance and stack (chimney) emission of HHK brick making unit, which have been verified by BUET in its report on EE brick kilns;*
- *A satisfactory outcome has been achieved by increasing the share of brick from HHK in the brick sector to 2.2% at the EOP, and resulting in a cumulative energy saving during the Project period of 8,365TJ and GHG reduction of 639.74kilo tonnes of CO<sub>2</sub>.*
- *Overall, the project has greatly assisted in elevating the general awareness amongst the policy and decision makers about the energy efficient brick making process and its direct benefit on the environment due to significant reduction in the emissions, year-round operation which provides job stability to the workers and their family and better working environment for the workers especially women. Another outcome is that the Government of Bangladesh has earmarked BDT 1 crore (10 million) per year towards budgetary support for promoting efficient BMI in the annual budget 2016.*

Rating:           relevance:    6  
                           effectiveness: 6  
                           efficiency:     5  
                           overall rating: 5.7

The growth of construction industry coupled with urbanisation, increasing incomes and the need to have a permanent dwelling unit has fuelled the demand for bricks. Over the past 10 years, it is estimated that demand for bricks have grown at a steady pace of 5% per year. To meet the steadily growing demand of bricks the number of brick kilns have grown rather rapidly and have been recognised as a major source of GHG emissions and contributor to

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<sup>14</sup> This would include the 5 model HHKs, 20 additional BMI reported by BUET. The Secretary, BABMA during the interview mentioned 35 number of HHK based BMI are operational.

declining air quality in most part of the country. Due to climatic factors, operation of the brick units has remained seasonal and the nature of business has also remained semi-formal with entrepreneurs following a path to maximize return with minimum financial risk. This has been the main factor for the brick units remaining trapped in a process which is over a century old and very little concerted effort went into find an alternate solution until recently when UNDP/GEF stepped in. The GEF PDF-B paved the path for introducing an energy efficient brickmaking process and the experience led to the design of programme to remove barriers to efficient brick making through a full-size project.

The project overcame various challenge and has been successful in introducing energy efficient kilns in the brick making units of Bangladesh to replace the existing FCK technologies with the aim to reduce emission of smoke and other harmful particulates and improve local air quality as well. With the technical initiation of the energy efficient kilns (EEKs), the project also provided different back-stopping support for wider use of EEKs i. e. technology options, demonstration projects, policies and regulations, capacity building of BMI operators and probable financial sourcing institutions and a massive awareness building among different stakeholders. A number of HHK demonstration plants have been established along with conducting various technical and non-technical supporting activities i. e. techno-economic studies, capacity building of workers and entrepreneurs, developing better investment facilities, policy related development and creating large scale awareness among the existing and future entrepreneurs and the policy makers. The project attracted additional funding of USD 90,000 from MDTF and completed the Gender related intervention supported by Global Gender and Climate Alliance which studied the role of women and the scenario of female workers in brick making industries; and prepared a 'Green Economy Action Plan', and USD 1million received from UNDP TRAC fund was used to prepared a roadmap for setting up a 'brick centre' to serve as a central source of information for prospective entrepreneurs and investors.

Project efforts were significant in bringing together key stakeholders – government agencies, brick makers, financial institutions, international development banks, Civil Society Organizations, consulting firms, academia - to raise awareness about energy efficient and environment safe brick making process with year-round operation. The various studies and public interaction done by project was important in country context, and the project managed to provide all-round inputs for the development of brick making sector.

The project provided policy inputs and assisted in preparation of the 2013 Brick Act. It worked with banks and brought the understanding of energy efficient kiln, thus building the capacity of financial institution to carryout appraisal of brick units investing in such technology. As a result, over 20 private brick units became operational with private and bank financing. By EOP, the project has leveraged an estimated investment of USD 77million in HHK based brick making units.

Table 3 summarizes the GHG reduction estimates to June 30, 2016 that were generated during IKEBMI using GEF guidelines<sup>15</sup>. Direct emission reductions were based on:

- Actual energy consumptive data reported from 24 HHK brick making units; and
- the GEF method for calculating GHG emission reductions.

**Table 3: Summary of CO<sub>2</sub> Reductions from the Project**

<b>Total direct emission reduction, t CO<sub>2</sub></b>	639,740
<i>Total direct post-project emission reduction, t CO<sub>2</sub></i>	0
<b>Indirect emission reduction, t CO<sub>2</sub></b>	
Indirect bottom-up emission reductions, t CO <sub>2</sub>	8,224,321
Indirect top-down emission reduction, t CO <sub>2</sub>	1,644,864

No post-project direct emission reductions were calculated since there are no revolving funds set up by the project. Indirect emission reductions consist of:

- Bottom up reduction is based on:
  - BUET study<sup>16</sup> conducted under the Project that established replication of EE technologies in 21 non-model units and 2 model through IKEBMI efforts leading to lifetime indirect GHG emissions avoided of about 8,224,321 tonnes. This represents the emission reductions from brick units which have installed HHK in lieu of conventional FCK where the emissions and air-quality issues are higher due to large quantity of coal consumption. In terms of annual production, the HHK type units have production capacity of nearly 3 times that of a FCK brick making unit. Thus, a total of 23 units are equivalent of 69 FCK units. The specific energy consumption compared to FCK is much less in HHK while various emissions including GHG and other pollutants such NO<sub>x</sub>, SO<sub>x</sub>, suspended particulate matter which are the main contributors to the deteriorating ambient air quality, are well below national standards; and
- Top-down reductions are based on:
  - the average emission avoided of 639,740 kilotonnes CO<sub>2</sub> by 23 non-model replicated brick making units using HHK technology, and;
  - a top-down lifetime GHG emission avoided of 1,644,864 tCO<sub>2</sub> considering a 40% causality factor

<sup>15</sup> “Manual for Calculating GHG Benefits of GEF Projects: Energy Efficiency and Renewable Energy Projects, April 16, 2008 (GEF/C.33/Inf.18)”

<sup>16</sup> A comprehensive study on the Present status, Performance, Barriers, and Prospects of Existing Hybrid Hoffman Kilns operating in Bangladesh

### 3.3.2 **Component 1: EEK Technology support programme**

#### Intended Outcome 1:

- Comparative study on competing technologies on brick making in Bangladesh
- Clay resource assess and sources identified for HHK demo by EOP
- Annual operating performance of HHK demo units evaluated by EOP
- Annual reports submitted on incorporating improvement on energy performance in each HHK.
- Energy reporting system developed and used to report on energy performance on demo HHK
- Database developed for light engineering and consultancy services in the vicinity of demo HHK

#### Actual Outcome 1:

- *A satisfactory outcome has been achieved in working towards the improvement in specific energy consumption in the brick making industry. Though the specific energy consumption in making brick in energy efficient kiln has reduced however the overall penetration of HHK is not large enough to effect improved in the energy consumed in Bangladesh's FCK dominated brick sector;*
- *A satisfactory outcome has been achieved for comparative study on different brick making technologies. Towards the end of the project a comprehensive study was carried out by BUET which included kiln efficiency and stack emissions from four HHK based brick making units;*
- *A moderately satisfactory outcome has been achieved for the activity for completing 11 clay resource assessments studies;*
- *A satisfactory outcome has been achieved in completing 5 Performance evaluation studies of the operational demonstration plants. Since the private sector had picked up on the HHK technology, the project took a decision to restrict the number of demonstration to five;*
- *A moderately satisfactory outcome was achieved with the development of 2 brick making unit's energy reporting system which were used to report energy performance of each demo projects;*
- *A satisfactory outcome was achieved in development of Database on light engineering and consultancy services for 13 HHK demo plants.*

*Rating:           relevance:    6*  
*effectiveness: 5*  
*efficiency:    4.5*  
*overall rating: 5.2*

The activities of this component picked up in 2011 after the inception workshop. Much of the activities that were implemented under this component served as the base work for activities of other two components related to technology aspects of HHK. For instance, the clay resource assessments studies were carried out for proposed HHK demonstration kilns included laboratory tests which concluded that though chemical properties of clay met the necessary composition of clay for HHK brick production, physical properties have some variations from the standards set by Xian. The project, therefore, made design modifications to improve the drying process. The HHK demonstration units that went for commercial production received technical guidance from the project to stabilize the operation and also to improve the quality of brick for acceptance in the market.

Thus, the techno-economic feasibility studies, baseline studies, detail implementing requirements and detail designs were developed for the HHK demonstration plants captured the learning of the design changes needed to suit the operating condition of Bangladesh. Thus

this component's activities provided the necessary learning which reduced the technology risk associated with a HHK<sup>17</sup> and helped its roll-out in Bangladesh in a very different climatic conditions.

### 3.3.3 Component 2: EEK Demonstration programme

#### Intended Outcome 2:

- 4.0 x 10<sup>-6</sup> TJ/brick energy consumption;
- 20 consultations each year with potential HHK investors and entrepreneurs
- 15 HHK technical feasibility study by EOP
- 15 reports on implementation requirement for HHK demo by EOP
- 15 surveys of baseline brick production and coal consumption by EOP
- 15 final designs of HHK by EOP
- Financial closure of 15 HHK demos by EOP
- 16 demonstration HHK technology application projects established and operational by EOP
- 100 participants in dissemination seminar

#### Actual Outcome 2:

- *A highly satisfactory outcome has been achieved on the consultation services provided by the project about the HHK based brick making unit. By EOP, consultation have been provided to a total of 134 interested entrepreneurs;*
- *A moderately satisfactory outcome has been achieved in carrying out technical feasibility study. By EOP, the project has completed 11 feasibility studies for HHK brick units;*
- *A moderately satisfactory outcome has been achieved for study conducted on implementation requirements. By EOP, 13 implementation requirements studies were prepared;*
- *A moderately satisfactory outcome has been achieved for study conducted on implementation requirements. Total 12 baseline studies were completed by EOP.*
- *A moderately satisfactory outcome has been achieved for preparation of design package for HHK. By EOP, 11 design packages were prepared.*
- *A moderately satisfactory outcome has been achieved for financial closure for proposed HHK projects. By EOP 11 financial closure for HHK projects were prepared and submitted to the entrepreneur.*
- *A moderately satisfactory outcome has been achieved for preparation of evaluation reports for the demonstration project. By EOP, 3 evaluation reports were prepared as remaining 2 demonstration project were stalled due to issues with the management of the brick units.*
- *A moderately satisfactory outcome has been achieved for conducting result sharing and dissemination workshop. One workshop was conducted where the results of demonstration project were shared with the stakeholders.*

Rating:           relevance:    6  
                       effectiveness: 6  
                       efficiency:    5  
                       overall rating: 5.7

<sup>17</sup> HHK is essentially designed in China to suit to the local soil and environmental conditions

The project helped in setting up of 5 HHK demonstration plants and provided the necessary technological and financial information to 40 interested entrepreneurs and also conducted visit to the existing HHK demonstration plants. 4 techno-economic feasibility studies, 3 baseline studies, 4 implementation requirements have been prepared for the establishment of the proposed HHK demonstration plants. The technology promoted by the project, Hybrid Hoffman Kilns (HHKs), consumes approximately 50% less coal than conventional brick kilns, resulting in significantly less global and local air pollution. Whereas traditional brick making in Bangladesh is primarily seasonal in nature, confined to the 5-6 dry months of the year, HHKs have roofs and can therefore operate year-round, resulting in more secure livelihoods for labourers. In addition, approximately 15% of labourers in the brick making industry are women. The demonstration HHK plants set up by the project have made it a point to provide a more equitable division of labour and an improved work environment for women.

### 3.3.4 Component 3: EEK Technical and Management Capacity Building programme

#### Intended Outcome 3:

- 500 production personnel trained and certified in vocational aspects of brick making starting Year 4
- Assessment completed of capabilities of light engineering services with a 10 km radius of the 16 HHK demo projects by Year 4
- 5 advisory discussions at each of the 16 HHK demos on improving local engineering services by EOP
- Feasibility study on standardization of brick kiln and associated equipment by Year 3
- Over 50 participants annually successfully complete training course on design, feasibility evaluation construction and O&M for HHKs
- 30 entrepreneurs provided with technical assistance to plan HHKs by EOP

#### Actual Outcome 3:

- *A moderately satisfactory outcome has been achieved in imparting training to more than 300 production personnel. Majority of the workers of the brick making units are seasonal workers and have only skills in traditional brick making. Organization of Auto Brick manufacturers association, can facilitate and accelerate the training to the staff, however, BABMA came much later in the project to take the benefit of the training;*
- *A satisfactory outcome has been achieved in the preparation of 13 assessment reports of the capabilities of light engineering service firms that can provide maintenance service to brick units. The study was carried out to assess the capacities of local engineering workshops to service and maintain HHK equipment that are functional in few brick making units;*
- *A moderately satisfactory outcome has been achieved with regards to Advisory discussion have been conducted based on 13 proposed HHK demo plants. 5 advisory discussions at each of the 16 HHK demos on improving local engineering services by EOP;*
- *A moderately satisfactory outcome has been achieved for conducting 3 feasibility studies on the Standardization of Brick Kilns and Associated Equipment. The studies were necessary to optimize the design of HHK to suit the local ambient operating conditions to maintain performance for year round operation;*
- *Conducted training Course on the Design, Feasibility Evaluation, Construction, Operation and Maintenance of HHKs. The project has provided training to 70 personnel;*



- *A satisfactory outcome has been achieved with the Technical Assistance provided to 22 entrepreneurs to plan HHKs.*

*Rating:           relevance:    6*  
*effectiveness: 5.5*  
*efficiency:     5*  
*overall rating: 5.5*

The component was designed to build the local capacity and transfer the knowledge to local entities to design, build, operate, and maintain HHK units that are built with the assistance of project. Also, the activities have been included to standardize the design of brick kilns and its critical equipment. Much of the planned activities were completed by EOP. The indirect evidence of the success of capacity building efforts comes from the number of new HHK brick units that have been built during the life of the project.

### 3.3.5 Outcome 4: Communications and Awareness programme

#### **Intended Outcome 4:**

- *Develop a business plan on BMI information Centre*
- *Develop IKEBMI project brochure*
- *Prepare video documentary on Brick making industry, IKEBMI and Hybrid Hoffman Kiln*
- *Awareness campaign on energy conservation and promotion advocacy*
- *Sensitize media about the brick industry and energy efficiency in brick making*
- *Conduct media tours*

#### **Actual Outcome 4:**

- *A satisfactory outcome was achieved in Develop a business plan on BMI information Centre. 1 business plan has been prepared;*
- *A satisfactory outcome was achieved Develop IKEBMI project brochure. The project has organized a 5-day long National Brick Fair with HBRI*
- *Total 5 video documentaries have been prepared;*
- *One campaign on ECA & PA has been conducted High level government mission went to China to experience the transformational shift of their Brick Making Industry and energy efficiency*
- *1 Journalist fellowship has been provided.*
- *3 Media tours have been completed;*

*Rating:           relevance:    6*  
*effectiveness: 5*  
*efficiency:     6*  
*overall rating: 5.7*

The project has done an excellent job in outreach and communications. The project has been featured about 69 times in various local and international media including the Daily Star and Al Jazeera. It has also produced three documentaries and organized a number of successful awareness raising campaigns in the division which received wide attention of

the people. The project engaged local government administration during the campaign thus creating awareness among the government officials and the local decision makers. The project started a unique fellowship for the journalist who worked closely with the project and later contributed articles in the print media. The project, thus worked in creating awareness amongst various layers of the society to create unanimity about the importance of introducing new technology in brick making to mitigate the harmful effects of prevailing age-old techniques.

### 3.3.6 Component 5: EEK finance support programme

#### Intended Outcome 5:

- Action plan prepared for financing HHK demos for Year 1.
- Techno-economic feasibility studies of 15 HHK demos by EOP
- Officers from 10 different financial institutions engaged in HHK investments discussions by EOP
- Linkages between 15 Entrepreneurs and 5 banks by EOP
- At least 50% of financial institutions funding HHKs offers concessional loan by EOP
- At least 16 HHKs registered for CDM revenues by EOP.

#### Actual Outcome 5:

- *A satisfactory outcome has been achieved with the preparation of 1 set of action plan to finance HHK;*
- *A highly satisfactory outcome has been achieved in the completion of 11 techno-economic feasibility studies;*
- *A highly satisfactory outcome has been achieved in engaging financial institutions to invest in HHK. By EOP, 67 discussions have been conducted with 13 commercial banks and financial institutions. Government of Bangladesh in its annual budget for 2016-17 has earmarked USD 12.3 million for the improvement of the brick making industry;*
- *A number of financial institution have started lending to HHK based brick units. Additionally, 52 banks and PFI have signed 'Participation Agreement' with Bangladesh Bank to extend ADB loan for 'Financing Brick Kiln Efficiency Improvement';*
- *A satisfactory outcome has been achieved with the project identifying 1 new financial sources. The project had the provision to source funding for efficient brick kilns, since it contributed to reduction in emission, by following the route of selling certified emission reductions (CER)<sup>18</sup>. However, the CER prices in the international market started declining steadily since 2008 from US\$20/ton due to oversupply and by 2012 the price of CER reached to a low of US\$5/ton at which its sale was no longer a financially attractive option;*

Rating:            *relevance:     6*  
                          *effectiveness: 6*  
                          *efficiency:     5*  
                          *overall rating: 5.7*

<sup>18</sup> The *Clean Development Mechanism* which was set up under the Kyoto Protocol, allowed emission-reduction projects in developing countries to earn Carbon credits known as 'Certified Emission Reduction (CER)' credits, each equivalent to one tonne of CO<sub>2</sub> emission avoided. These CERs could be traded and sold, and used by industrialized countries to a meet a part of their emission reduction targets under the Kyoto Protocol.

The first two years went into preparatory studies listed above to engage the financial institutions for making investment in HHK units. Due to the nature of business of brick making, which is semi-formal, there have been reluctance on the part of banks to fund the HHK projects. The banks maintained a ‘wait and see’ strategy. The project had a number of discussions with IDCOL and due to a combination of communication and awareness building efforts, the understanding of the technology and the business prospects of HHKs came in and it started to receive proposals for financing HHK projects. The key achievement has been the replication of HHKs in Bangladesh.

The major boost and encouragement to IKEBMI’s effort to improve financial support to HHK based brick making units came from ADB USD 50 million loan to Bangladesh Bank for ‘Financing Brick Kiln Efficiency Improvement’ which was approved in October 2012. IKEBMI played an active role as an intermediary between the banks and entrepreneurs and helped to process and negotiate the proposal. This broke the ice and helped in processing of a number of proposals for financing. In June 2016, ADB disbursed USD16.2 million for eight brick kiln projects of which six were HHK and two tunnel kilns. Thus this particular component greatly facilitated the replication of HHK through capacity building of financial sector players. Another important achievement of UNDP IKEBMI project was its focus on addressing the root cause of environmental issue in Bangladesh and the attention it generated, the project indirectly engaged the World Bank and ADB to focus on the brick sector with their respective projects.

### 3.3.7 Component 6: EEK policy development and Institutional support programme

#### Intended Outcome 6:

- About 2.2% of brick production in Bangladesh is compliant to set emission standards for brick kiln operations by Year 3
- Improvement of GOB awareness and commitment to enforce a favorable regulatory regime for the brick making units
- Formulation of policies and implementing rules and regulations for the BMI drafted by Year 4
- Implementation of policy support activities (Draft brick quality standards by Year 3)
- Capacity building on energy efficiency policy and regulation in brick making process
- Formulation and implementation of strategies to minimize land degradation from brick making activities

#### Actual Outcome 6:

- *A moderately unsatisfactory outcome has been achieved with 1 Workshop and 1 visit have been conducted for awareness creation of government officials;*
- *A satisfactory outcome has been achieved with project preparing a draft Implementation rules and regulation and a review of “Brick Manufacturing and Brick Kiln Setting (Control) Act, 2013” and proposed set of recommendations for its amendment;*
- *A satisfactory outcome has been achieved with the project preparing a draft brick quality standard based on dimension, classification, appearance, water absorption, average comprehensive strength, tendency to efflorescence, quality of raw materials;*
- *A satisfactory outcome has been achieved for project contributing to the preparation of Strategies and regulations on minimizing land degradation from BMI activities;*

*Rating:*            *relevance:*    5  
                         *effectiveness:* 5  
                         *efficiency:*     5  
                         *overall rating:* 5

Since the project started, there has been a gradual shift in the perception of the brick making industry in the country. One of the most important initiatives by the Government of Bangladesh has been to change the brick making act. Previously the related Act was titled “Brick Burning Control Act”, indicating that the Government of Bangladesh did not perceive the sector in its entirety. The act did not include any provisions to support the manufacturing on non-fired bricks and the act focused on putting a ban on the use of firewood in brick manufacturing. The new act changed its title to “Brick Manufacturing Act,” and also changed its whole approach. The project was actively engaged with the government in 2011 and 2012 and provided necessary inputs to the draft Act for its improvement.

In 2016, Government has taken up the amendment of the ‘Brick Manufacturing and Brick Kiln Setting up (Control) Act, 2013’ and the project commissioned a review of the Act with Bangladesh Environmental Lawyers Association (BELA) and provided a set of comments necessary for amendment of the act.

### 3.3.8 Overall Evaluation of Project

The overall rating of the Project results is satisfactory (S). This is based on the following outcomes:

- The Project has overcome the barrier identified in the project document and have put in significant effort during the past 5 years to seed the concept of energy efficiency in brick making. The improved HHK based brick units have increased rapidly and are competing with the traditional kilns. Since IKEBMI project started, the whole BMI paradigm that has prevailed for the past century has undergone a complete change as a result of the sustained awareness creation carried out through various medium, several studies and the demonstration of various brick production technologies which have been demonstrated in Bangladesh by UNDP and the World Bank. Study tours of The HHK brick unit operate throughout the year and therefore its annual production volume is much higher than FCK or improved Zig-zag kiln, which operate in the dry season. Due to large volume production and superior product, the brick from HHK are readily sold to contractor and builder who are involved in construction activities.
- The project has built a solid foundation and should be regarded as the fore-runner bringing about the much needed change by introducing modern clean and efficient technique in brick making;

- The project's work received international recognition when it was presented in Rio+20 conference and it managed to receive additional MDTF and UNDP TRAC funds for Technical Assistance. On a conservative side the project has been successful in leveraging nearly 5 times more investment from entrepreneurs and banks as a part of 'co-financing';
- The Department of Environment has acknowledged that 105 entrepreneurs have taken license from them and about 60 kilns are now in production, although this number needs validation since different sources have provided different numbers which greatly differ. Nonetheless, more than expected number of replications has taken place during the life of project. The demonstrations and interventions by the project have directly and also indirectly played a role in inspiring these replications which is acknowledged in the MTR;
- The project has been able to create consensus among the major role players in the brick industry about the possible measure such as creation of a brick centre, certification of brick technologies and products, research and demonstration, which will provide a solid base both at gov. and private level to mobilize resources to benefit the industry keeping pace with the environmental and energy concerns. Although, most of the expectations were met, the central role of the information management and advisory services were not achieved as the project and the partners were not able to establish the Brick Centre, which requires some serious discussion with the counterpart government organization about where the centre would be located (within the government setup), what will be its functions, man-power requirement and their expertise and lastly the source of funding after the end of the project;
- The project put in great deal of time and effort for awareness creation. The project held Regional Awareness Campaign at four divisions which attracted community personals and involved school children in the event who were made aware about the environmental effects of the FCK brick kiln and its modern alternatives through audio-visual, docu-drama and distribution of project brochure and other communication materials created massive awareness among the local people. In order to bring the awareness amongst the print media, the project provided fellowship to two regular journalists titled as 'Green Fellow', who worked closely with the project and carried out investigative reporting related to BMI., the journalist fellow published an article in one of the leading daily newspaper "The Daily Star". The project activities received good coverage among local TV channels as well as international TV channels such as Aljazeera.
- From the time project started, there has been a gradual shift in the perception of the brick making industry in the country. For example, in terms of policy development, Brick Burning Act which was renamed as Brick Manufacturing Act benefited from UNDP advocacy efforts and also written feedback was provided to the draft Act for its improvement. IKEBMI project provided engaged eminent environmental advocacy firm to review the 2013 Act and provide feedback as MoEF was soliciting feedback to amend the Act.
- Project made good use of the additional funds it received and implemented GGCA supported "Gender in Focus: Piloting Gender Support on Energy Efficient Brick Kiln" which looked at the gender related matters. The pilot study provided health support to the female

workers of HHK demo kilns, provided training to empowering the female workers through labour and social rights;

- By the EOP, about 23 HHK based brick units were operating and another 16 HHK units are under various stages of construction. The project has thus, seeded the HHK technology, which also emerges as most suited to address the air-quality issue according to the World Bank study. The project was successful in obtaining additional financial support from sources other than those committed at the time of Prodoc approval. The project received USD1 million from UNDP TRAC funds and USD 60,000 from Dutch Government and USD30,000 from Global Gender and Climate Alliance through Multi-Donor Trust Fund. Co-financing from the stakeholders amounted to USD 77.6 million.

Overall project ratings are provided on Table 5.

**Table 5: Ratings for Each Project Outcome<sup>19</sup>**

	Relevance	Effectiveness	Efficiency	Overall Rating
<b>Monitoring and Evaluation:</b>				
M&E design at entry	-	-	-	4
M&E plan implementation	-	-	-	5
<i>Overall quality of M&amp;E:</i>	-	-	-	4.5
<b>UNDP and Executing Partner Performance:</b>				
Quality of UNDP implementation	-	-	-	5
Quality of Execution – CEA and Xian	-	-	-	4
<i>Overall quality of implementation/execution:</i>	-	-	-	4
Overall Results	-	-	-	4.7
<b>Outcomes:</b>				
<u>Component 1:</u> EEK Technology support programme	6	5	4.5	5.2
<u>Component 2:</u> EEK Demonstration programme	6	6	5	5.7
<u>Component 3:</u> EEK Technical and Management Capacity Building programme	6	5.5	5	5.5
<u>Component 4:</u> Communications and Awareness Programme	6	5	6	5.7
<u>Component 5:</u> EEK finance support programme	6	6	5	5.7
<u>Component 6:</u> EEK policy development and Institutional support programme	6	5	5	5.3
<b>Overall Rating:</b>	<b>6</b>	<b>5.4</b>	<b>5.1</b>	<b>5.5</b>

<sup>19</sup> 6 = HS or Highly Satisfactory: There were no shortcomings; 5 = S or Satisfactory: There were minor shortcomings, 4 = MS or Moderately Satisfactory: There were moderate shortcomings; 3 = MU or Moderately Unsatisfactory: There were significant shortcomings; 2 = U or Unsatisfactory: There were major shortcomings; 1 = HU or Highly Unsatisfactory.

### 3.3.9 Sustainability of Project Outcomes

In assessing Project sustainability, the evaluators make inquiry about “how likely will the Project outcomes be sustained beyond Project completion?”. In case of IKEBMI

The overall Project sustainability rating is likely (L). This is primarily due to:

- Greater awareness about the merits of energy efficiency kilns, HHK in particular compared to other kilns, and willingness to invest in this technology. From the time project execution started in 2011, DOE had granted approval to approximately 105 applications for setting up HHK based brick kilns;
- Department of Environment is contemplating amending the 2013 brick manufacturing act to accommodate energy efficient kilns and putting a limit on the emission from brick kiln and provide industry status of brick making units;
- Substantially low level of stack emissions from HHK brick units. The measured pollutant level for Carbon monoxide (CO), Nitrous Oxide (NOx), Sulphur Oxide (SOx), and Carbon dioxide (CO<sub>2</sub>) were much below the Bangladesh National Standard ECR97. The suspended particulate matters (SPM) emissions level are also measured to be far below the national standard<sup>20</sup>;
- Presence of local firms in Bangladesh who provide technical design inputs for setting up HHK based kilns;
- Presence on continued engagement of other multilateral agencies – The World Bank and Asian Development Bank to work with Government of Bangladesh to address the environmental issues of air pollution and depletion of top soil in brick making throughout the country;
- Strong responses from BABMA to adopt EE in brick making as a means of reducing their energy operational costs, and to produce brick which get greater acceptance in the market and civil construction industry due to its superior technical characteristics;
- Availability of a pipeline of USD 34 million to Bangladesh Bank from ADB’s line of credit and willingness of another 52 Private banks and financial institution to provide debt finance for energy efficient kiln, especially HHK;
- By EOP there are over 25 HHK based brick manufacturing units that are commercially operation and another 16 HHK based units are under construction<sup>21</sup>;
- There are at least 11 agencies<sup>22</sup> that are working as private service providers of EE Brick Technology and providing construction support and machinery for HHK;

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<sup>20</sup> A Comprehensive study on the present status of Hybrid Hoffman Kilns in Bangladesh – BUET report, April 2016

<sup>21</sup> Ibid

<sup>22</sup> A Comprehensive study on the present status of Hybrid Hoffman Kilns in Bangladesh – BUET report, April 2016, Refer Annexure VIII ‘Technology Service Provider’s Information’

### 3.3.10 Catalytic Role and Impact

In addition to sustainability the terminal evaluations are required to include an assessment of catalytic or replication effect played by the GEF financed project. The four parameters that are considered for assessing the catalytic role of the project are: production of public goods; demonstration; replication and, scaling up.

GEF financed projects are required to describe the extent to which the project has achieved or progressing towards the achievement of impacts. In that respect, IKEBMI has created impact among several private, not-for-profit organizations and government ministries about the issues of conventional FCK and merits of HHK. The project has created an awareness towards the environmental and air quality issues linked with conventional FCK. It has further drawn attention towards the occupational health conditions of semi-skilled and unskilled workers (both men, women and their children) are subjected to the working environment in FCK and documented a contrasting working condition in HHK brick kilns. On the technical side, the project demonstrated significant reduction in specific energy consumption, GHG and particulate emissions. The project has also documented health benefits of HHK which provides clean and safe working conditions and economic benefit to the work force due to year-round operation of the kiln.

The project's contribution to introducing an energy efficiency brick making technology has been found to have significantly low stack (chimney) emissions from those brick kilns. The emission levels have been measured to be far below the national air quality standards for different pollutants as well as CO<sub>2</sub> which is the main greenhouse gas responsible for global warming. The improved design and operation of the brick kilns mainly contributes to the efficiency which reduces specific energy consumption in brick making leading to lower coal consumption and thus contributes lower GHG level as compared to FCK. The improved efficiency of HHK as compared to FCK has been further validated by World Bank in its report on 'Introducing Energy-efficient Clean Technologies in the Brick Sector of Bangladesh'<sup>23</sup>.

The project has held interaction with the government, Department of Environment and provided inputs which helped the government to draft a bill on brick manufacturing which was enacted in 2013. The project helped to establish HHK and also bring a greater understanding about bank financing of energy efficiency processes in brick making. The project worked with local private sector players to build their capacity and support replication. By the EOP, about 23 HHK based brick units were operating and another 16 HHK units are under various stages of construction. The project has thus, seeded the HHK technology, which also emerges as most suited to address the air-quality issue according to the World Bank study. With the availability of ADB funds for Financing Brick Kiln Efficiency improvement, there is a likelihood of sale up of HHK technology.

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<sup>23</sup> World Bank Report No. 60155-BD, June 2011



## 4 CONCLUSIONS, RECOMMENDATIONS AND LESSONS

### 4.1 Conclusions

- The design of the IKEBMI Project, its goals and objectives as stated in the PPM were clear, however the project and component level outcomes were ambitious, which led to a revision of PPM within few months of the setting up of project implementing unit. The revised PPM, which was presented at the project inception meeting, had toned down the success indicator of overall project and all the six components. The project operated as Directly Executed mode and followed a multi-pronged approach to remove barriers to the acceptance of an energy efficient brick making technology with lower emissions. The project design had given greater emphasis towards the technology aspects of energy efficient kiln, since three out of the six components were related to demonstrate and build local capacity to use HHK technology. As a result, towards the later stage the project was adaptively managed by UNDP to focus on other nontechnical aspects of brick making. This was an important step to bring a balanced view of the sector in the local context by undertaking studies on social, economic and health related aspects associated with brick making which employs semi-skilled and unskilled workforce.
- Project efforts were significant in bringing together key stakeholders – government agencies, brick makers, financial institutions, international development banks, Civil Society Organizations, consulting firms, academia - to raise awareness about energy efficient and environment safe brick making process with year-round operation. It highlighted social, economic and health benefits for work force engaged in 'EE' brick kilns which includes about 20% women. This aspect was important in country context, and the project managed to provide all-round inputs for the development of brick making sector.
- While the technology solutions for brick making to reduce energy consumption and stack emissions are straight forward and well understood, their implementation is more complex. This is due to a number of approvals and permits required in setting up a brick making unit, including large area of land (and at slightly higher elevation to avoid getting affected by monsoon floods) and the cost of technology, all of which taken together increases the overall capital required in setting up an energy efficient brick making unit. Delays in obtaining permits effects the entrepreneurs' ability to achieve financial closure in a definite time period and move ahead with setting up of brick kiln and, start commercial production.
- The IKEBMI Project contributed to the accelerated growth of the energy efficient kilns in Bangladesh since 2011:

- It provided a structured approach to removing barriers to deployment of EEK by focusing GEF resources on raising awareness, supporting the demonstration of energy efficient HHK technology which also created greater awareness about the year-round brick production and improved working conditions. The barriers identified at the start of IKEBMI have been addressed by EOP. Equipped with experience of EEK operation, government is actively engaged in preparing a roadmap to reduce emissions from brick kilns.
  - The Project generated useful analytical reports, audio-visual materials, provided wide publicity through TV about climate change, air quality issues and comparison of traditional brick making process with energy efficient kiln being demonstrate by UNDP. These knowledge products and services helped to raise awareness of EEK systems to a wide range of stakeholders in divisions having large number of brick kilns;
  - Due to long lead time in obtaining necessary permits and setting up the brick kilns with higher investment the project had only 5 demonstration projects. However, the successful outcome of PDF-B had motivated a number of entrepreneurs, who took the initiative to invest in HHK. Consequently, at the time of EOP, around 35 HHK were reported to be operational in various parts of the country. Considering, the project started with one HHK brick kiln, the project did very well to introduce HHK as an energy efficient brick manufacturing process which had additional advantage of year-round production of brick, lower coal consumption and therefore reduced emissions of GHG, particulate and other pollutants in the chimney (stack).
  - Limited number of demonstration project influenced approximately four times more investment in EEK. According to BUET's recent study, approximately over 25 kiln<sup>24</sup> that were built using HHK technology are operational. These taken together leveraged an estimated investment of approximately USD 72.5m in HHK based brick production. ADB's D50m Line of Credit to Bangladesh Bank to provide concessional interest rate debt financing for brick industry to set up EE kilns is a major factor that will ensure that the investments in HHK continue after EOP. The owners of EEK have come together and formed an association known as Bangladesh Auto Brick Manufacturer's Association (BABMA) which is lobbying with the government for the 'industry' status for EEK to create a level playing field with traditional FCK, and encourage investment in EEK.
- IKEBMI Project has done very well to overcome the barriers in the brick sector and achieving most of the project level outcomes by EOP considering the resources available. The project has accelerated growth of the EEK after the launch in 2010 and increased the market share of bricks produced from EEK. The project received co-financing contribution from the entrepreneurs of USD72.5million and an additional USD16million from ADB for

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<sup>24</sup> As reported in BUET report to UNDP, submitted in August 2016.

setting up EEK for brick making. Overall, co-financing contribution towards the Project greatly exceeded the original targets.

- Although the IKEBMI project has achieved the overall project goals, the brick sector still requires several round of discussions among stakeholders to arrive at a clear direction on new technology choices for brick production in the future for brick making. This includes taking into consideration the air quality and use of soil, which is becoming a serious environmental issue, considering top-soil is essential for crop production and the country needs to ensure the production levels are maintained or increased to cater to the growing population.
- There is a need to expedite the revision of technical standards of bricks produced from EEK, and to find alternative materials that are locally available for making bricks and develop technical specification for its application in civil construction. Pilots studies and trial carried out by HBRI are encouraging and need greater attention as well as encouragement for carrying out trials in building using brick made of alternate materials.

## 4.2 Recommendations

High level of pollution contributed by the brick kilns and its rapid proliferation were long identified as the main cause of the deteriorating air quality. The project, encouraged by the successful outcome of the project development phase set forth to remove various barriers which prevented introduction of technologies and processes for brick making that are less harmful to the environment. While the IKEBMI project has been able to satisfactorily address the barriers and open the door for HHK and other energy-efficient process, these however remain at a nascent stage and require to be nurtured to address a bigger cause of GHG emission and particularly ambient air quality which effects a large population across the country. The following recommendations are reflection on the future course for the brick sector:

**Recommendation 1: UNDP should maintain engagement with brick sector and support government in developing a medium and long-term plan taking into consideration environmental, social and economic factors:** The Department of Environment is considering amending the 2013 Act which is expected to provide greater clarity on the technology choice to for brick making taking into consideration the environmental factors. Therefore, given UNDP's substantial engagement in the brick sector over the past decade, it is recommended that it continues engagement in the sector to increase the market share of building materials that are environment friendly. UNDP's follow-on program should follow the path to (a) support government's endeavor in finding alternate building materials that are developed using local resources, and use process that are less energy intensive and to (b) develop norms and specifications for using alternate building materials in different types of buildings and amend specification for its use bulk users (government and large builders) to gain public confidence on its use. In the follow-on phase the following are suggested:

- Expand circle of influence - involve Ministry of Agriculture and the Soil Research Development Institute to look into competing use of top soil for agriculture vs. brick making; support demonstration using alternate material (river bed sand, fly-ash bricks, compressed earth stabilized blocks)
- Additional study is suggested to compare brick making technologies on the basis of
  - CO<sub>2</sub> emissions and other pollutants, dust and SPM
  - Labour working conditions and occupational health and safety of workers
  - Investment requirements
  - Sourcing of raw material (mainly clay)

Such study will help identify technologies that have least environmental emissions and provide a safe working conditions for the workers.
- Work with the concerned government agencies towards revision of the brick standard so that the bricks produced from energy-efficient kiln find greater acceptance in the market

**Recommendation 2: The brick making sector should be granted industrial status to bring environmental and social safeguards, and provide better social, economic and health status to the work force.**

Higher capital need, larger area requirement and higher capacity of HHK technology compared to the others is a challenge for implementation of given small and medium size brick manufacturing enterprises in Bangladesh. The brick units need be encouraged to adopt an energy-efficient technology with low-emission, and having access to finance. The government should provide 'industry' status to brick making which can help to regularize them as small or medium size industry from being a semi-formal sector. Due to the nature of activity of using top soil, the government can regulate it better if it is developed as a formal sector, licensing, regulation and emission control will become easier. Due to lesser extent of manual work involved, efficient brick kilns provide better work environment and year-round employment to the work-force. Few additional activities suggested include:

- Conduct a proper census of brick kiln to develop a reliable baseline data. Current figures for various type kilns vary by source and there is lack of authentic reliable data;
- Create awareness among public, architects, builders, real estate about the efficient brick making technology and its social and environmental benefit for the country
- Setup targets and strategies to increase the share of 'EE' bricks from current ~2% to 10% and from 10% to 20% by say, 2030
- Benchmark the cost of brick making technologies and land requirement for each – helpful to determine the investment requirement to meet future demand of brick
- Conduct period chemical test (proximate analysis) on local and imported coal to keep track of its composition especially the carbon, sulphur and ash content. This would help the government agencies to track the GHG, particulate and SO<sub>x</sub> emissions in the environment.

**Recommendation 3: The system of issuing permits to construct and operate brick-kilns need to follow a fixed time frame and the information should be available to the Department of Environment:** A computerized database mechanism is required to be put in

place, which follows a transparent process and a fixed time-frame under which each of the permitting authority grants approval to set up and operate a brick kiln in area under its jurisdiction. This would help the government, particularly DOE, to have accurate information about the total numbers of brick kilns operating in any given year in any division of the country. Also, obtaining location clearance certificate and environmental clearance certificate (permits) in a time-bound manner will encourage investment in energy-efficient brick-kiln as the investor will have greater confidence for obtaining financial closure and start construction for commercial production in a definite time frame. Such mechanism will help the regulator (DOE) to plan ahead and factor-in air quality issue and gradually reduce the numbers of conventional brick kilns (FCK) around areas which have high-population or that are environmentally sensitive.

***Recommendation 4: Develop the capacity of Housing and Brick Research Institute to function as technical back stop for the government, financial institution for providing advice on the use of construction material and its sourcing based on environmental sensitivity and local factors.***

HBRI's capacity be built and it should be appointed as the technical back-stop to:

- Banks and PFI working with Bangladesh Bank using ADB LOC, need to be sensitized to various brick making technologies and improve their ability for project appraisal / increase lending;
- Fine tune the technologies sourced from other countries to suit to operating environment / conditions of Bangladesh. The technologies successful in other countries for brick making have been developed and fine-tuned to suit local condition. It is suggested that other alternative technologies for brick making, which are being considered should go through following steps before entrepreneurs are invited to invest in it:
  - Field trial of the process for at least one year under the varying climatic conditions to understand the variations on quality and find solutions to address the problem;
  - Field trial of the product (brick) in different types of building, such as office, commercial buildings, residential, institutional building, storage, disaster shelter, etc. ;
  - Develop specification and standards and notify them through the government process, to make the product acceptable in the market for use;
  - Provide training and guidance to entrepreneurs;

### 4.3 Lessons Learned

A concise Project planning matrix (PPM) with identified risks and assumptions is essential for effective project implementation. The IKEBMI project was successful in generating traction with

entrepreneurs, Civil Society Organizations, and government officials in division on technical and social aspects of energy efficient kiln, however, the project design had inherent problems which surfaced much later during the implementation stage.

The project was designed with six components of which three components were focused on the technical aspects of energy efficient kiln technology and remaining three were devoted towards awareness creation, project financing and policy and institutional support. development assistance. During the TE following design issues have been identified in the Prodoc and corresponding lessons learned are mentioned below:

- The project design was developed on the lines of a nationally executed project, however due to the requirement of technology development and promotion it was made a directly executed project (DEX) with implementation arrangement involving technology promoters as members of PMU. The CEA and XIAN team were responsible for five components, while UNDP was responsible for implementation of Communication and awareness.

The DEX mechanism is appropriate for projects which demonstrate new technologies and aim to create the required awareness and support system to sustain it through the means of training and capacity building among the local stakeholders. This provides a better utilization of the resources made available under the project and therefore, more effective.

The Project Management Unit (PMU) created under the project comprised of three organizations with split responsibilities which reduced the efficiency due to increased coordination effort during the project execution. A PMU with dedicated staff supported by firms assisting in technology demonstration and capacity building effort, should be the structure for future projects of similar nature.

- Although, CEA and XIAN were awarded work by UNDP through a Letter of Agreement (LOA), however the arrangement had budgetary and operational issues from the beginning, which delayed PMU becoming operational. UNDP signed two separate LOA with CEA and XIAN respectively, however, these two 'Project Cooperation Agreement' defined UNDP's expectations. The description of services broadly defined what is to be done and did not clearly mention the deliverables, timeline of completing various activities and a payment schedule linked to deliverables. Moreover, the description of services did not cover activities under Outcome 1 and Outcome 2.

The instruments of 'Letter of Agreement' and 'Project Cooperation Agreement' are better suited to engage a government agency for project execution, while the engagement of a private sector organization or a non-governmental organization should be through a contract issued by the funding organization (UNDP), with reporting requirement to the Project Management Unit which has the overall responsibility of project implementation. A contract has clearly defined deliverables, deliverable timeline, payment mechanism and termination clause is the appropriate instrument which should be utilized by the implementing agency.

- Many local stakeholders viewed CEA and XIAN as proponent of HHK having commercial interest in the Bangladesh market, and therefore, were not too comfortable in sharing their investment plans and information with the project.

The agencies in the PMU were also involved in project execution and had clearly a larger long-term business interest to create market. A PMU with dedicated staff and contract based engagement of CEA and XIAN by the implementing agency could have provided an arms-length arrangement in which PMU staff are the point-of-contact for the stakeholders and thereby avoid a future situation leading to conflict of interest.

- Steering Committee meeting are critical element of project, which allows engaging high level government officials to provide guidance to the project to overcome the challenges and, also assess the accomplishments made by the project key stakeholders. The project implementation plan included National Steering Committee and Technical Advisory Committee to guide the project, these committees did not meet during the first 3 years, and the project missed out engaging senior level officials from the Ministry of Environment and Forest.

Regardless of the structure of the project management structure, the business unit in the UNDP country office should ensure that the Steering Committee meeting is held at least once every year (and more frequently as demanded by the project) to maintain engagement with the key stakeholders. The Steering committee meeting provides an opportunity for the senior management of UNDP to interact with the government counterpart, provide direction to the project and helps to get an insight in the changing priorities to carry forward the policy dialogue. Such engagements greatly helps the project team to adapt to the changing landscape to generate greater traction in their work and deliver results which are acceptable to the local stakeholders.

- There is lack of guidance in the Prodoc to formulate strategies to engage stakeholders and soliciting stakeholder feedback to improve and respond to needs. Feedback from stakeholders would have included the difficulties of obtaining permits to setup a brick kiln in a time-bound manner, which is also essential to achieve financial closure with financial institutions leading to construction and commercial production.;

The projects are designed for execution to remove the barriers which inhibit the growth of the sector. Due to continuously changing political landscape in the host country, the project design should key options for greater dialogue with the stakeholders to be aware of the bottleneck which the project can potentially address and help to mitigate the effect. One such option mentioned above is the Steering Committee meeting. Similarly, the project design should include options of thematic workshops with different stakeholders to solicit feedback and find ways to address the emerging challenges which are counter-productive to the overall objective of the project.

- During the course of project implementation, circumstances change justifying the need to modify a PPM, namely its outputs and targets. In the case of this Project, the mid-term review (MTR) was delayed due to reasons beyond the control of CO. By the time, the

MTR report was accepted, the principal implementing partner's (CEA and XIAN) LOA with the project came to an end. The UNDP CO was left to complete several project tasks including the recommendations of MTR. The project did not receive timely advice on the progress of success indicator to take remedial actions. The Project team had to manage the Project under a PPM with issues detailed in the aforementioned bullet points.

The implementing agency and the RTA need to ensure that the key Monitoring and Evaluation activity – Midterm Review- is undertaken in a timely manner as it serves to provide the feedback on the implementation of project activities in a objective way. The midterm review also helps GEF and the implementing agency, with the documentation of the overall project progress, highlights the issues in the project with regards to the targets in the PPM and indicates the likelihood of the project activities reaching the targets, and lastly the likely delay in project completion.

- The project benefitted greatly with the involvement of other two major multi-lateral agencies, The World Bank and the Asian Development Bank, both focusing on Bangladesh's brick sector. The World Bank's report on Introducing Clean Technologies in the brick sector corroborates superiority of HHK technology in comparison to other available options on technical, environmental and health benefits. ADB's financial support for establishing EEK, as well as The World Bank's continued engagement in the sector has helped to address the project's sustainability. A formal, periodic meeting between the three agencies for information exchange would have benefitted the project by creating synergies on topics that are of common interest and for progress of respective agencies' work.

The UNDP project is the first project in the country to address the issues of pollution arising from the brick industry. The project, due to the limitation imposed by the structure of the PMU, as mentioned above, could not create synergies with the other multi-lateral donor agencies working in the same area (which is rare). All the 3 multi-lateral agencies could have greatly benefited from each other agencies' strength, as UNDP is strong on technical assistance and capacity building, while both the banks provide significant funding support to stir up the private sector players. With tightening budgets, the project management unit and implementing agencies should look at create ways to partner with other agencies and create synergies to achieve greater impact in the work.

The application of energy efficiency principles is slow to be accepted by brick kiln owners due to high capital requirement to migrate from conventional FCK to a high-efficiency HHK. Further, due to lack of standards for superior quality bricks being produced from HHK, the market for improved brick is yet to emerge. Creation of brick standards backed by technical advice of HBRI would help to create a market and increase the share of HHK brick making units in the country.



## APPENDIX A – MISSION TERMS OF REFERENCE FOR PROJECT FINAL EVALUATION

IMPROVING KILN EFFICIENCY IN THE BRICK MAKING INDUSTRY (IKEBMI) PROJECT TERMINAL  
EVALUATION TERMS OF REFERENCE (TOR) FOR INTERNATIONAL CONSULTANT

### INTRODUCTION

In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support GEF financed projects are required to undergo a terminal evaluation upon completion of implementation. These terms of reference (TOR) sets out the expectations for a Terminal Evaluation (TE) of the *Improving Kiln Efficiency in the Brick Making Industry – IKEBMI* (PIMS #2837)

The essentials of the project to be evaluated are as follows:

### PROJECT SUMMARY TABLE

Project Title:	Improving Kiln Efficiency in the Brick Making Industry (IKEBMI)			
GEF Project ID: #)	1901 (GEF PIMS #)		<u>at endorsement</u> <u>(Million USD)</u>	<u>at completion</u> <u>(Million USD)</u>
UNDP Project ID: PIMS#)	2837 (UNDP PIMS#) 00075326 (Atlas ID#)	GEF financing:	\$3,000,000	
Country:	Bangladesh	IA/EA own:		
Region:	Asia-Pacific	Government:	\$60,000	
Focal Area:	Climate Change	Other:	\$10,980,000	
FA Objectives, (OP/SP):	OP-5	Total co-financing:	\$11,040,000	
Executing Agency:	UNDP	Total Project Cost:	\$14,040,000	
Other Partners involved:	N/A	ProDoc Signature (date project began):		04-06-2010
		(Operational) Closing Date:	Proposed: 03-04-2015	Actual: 31-06-2016

### OBJECTIVE AND SCOPE

Improving Kiln Efficiency in the Brick Making Industry – IKEBMI Project is a GEF-funded, UNDP-supported project initiated in 2010. The main objective of the project is to remove barriers to the widespread adoption of energy efficient practices in the brick making industry of Bangladesh. Traditional brick making in Bangladesh is a highly energy intensive and carbon emitting activity and is a major source of deforestation and land degradation. Brick making operations in the country fall mostly within the informal small and medium enterprises sector and do not have financial or strong regulatory incentives to become more energy efficient.

Against this backdrop, the IKEBMI Project is working to promote energy efficient and environment friendly technologies in Bangladesh's brick making industry.

**Outcomes that contribute to this objective:**

**Outcome 1: Energy Efficient Kiln Technology Support Program:** thorough understudying and appreciation of technology options and their environmental impacts by brick makers, government and other stakeholders

**Outcome 2: Energy Efficient Kiln Demonstration Program:** Establishment of a critical mass of demonstration projects that will provide detailed information of EEK operations, energy savings and environmental impacts to interested brick makers

**Outcome 3: Energy Efficient Kiln Technical and Management Capacity Building Program:** Improved local vocational, technical and managerial capacity to manage and sustain operations of EEKs and EE practices in Bangladesh

**Outcome 4: Communications and Awareness Program:** Enhanced awareness of the public and other stakeholders on EEKs, EE molding practices and EEK brick products

**Outcome 5: Energy Efficient Kiln Finance Support Program:** Availability of financial and institutional support to encourage SME adoption of energy efficient kilns

**Outcome 6: Energy Efficient Kiln Policy Development and Institutional Support Program**

Promulgation of and compliance with favorable policies and regulations that encourage adoption of EEKs and EE brick making practices and methodologies

The project will be completed in June 31, 2016 after 14 months no-cost extension as per the MTR recommendations. The TE will be conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects. The objectives of the evaluation are to assess the achievement of project results, and to draw lessons that can both improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP programming.

Considering the innovative nature of the project - first of its kind in Bangladesh that addresses energy efficiency, air pollution and climate change mitigation - and technology intensive activities, and the direct technical assistance required by the private entrepreneurs in managing the project and accounting for emissions reduction, the project is under UNDP execution/implementation. It is being directly implemented by the private sector under the overall framework of the Country Programme Action Plan (CPAP) and following UNDP rules, regulations, procedures and guidelines where applicable. UNDP is providing support to the private sector in managing and coordinating the project through establishment of a Project Management Unit (PMU) headed by a Project Coordinator (PC).

As a Responsible Party, Clean Energy Alternative (CEA) Inc., played a major role in coordinating with the Bangladesh Brick Owners and Manufacturers Association (BBOMA), the Xian Institute of China and Financial Institutions for achieving the project objectives. CEA has conducted training needs assessment, technical training, manual development, technical training to local consulting firms, engineers and technicians, capacity development of financial institutions, facilitating the financial institutions to ensure project financing, feasibility studies including baseline data, business plan preparation, liaison and field support to Xian Institute for field implementation, develop BMI monitoring and reporting system, etc. The capacity assessment of the CEA was done during the PDF-B phase for accomplishment of the above activities and was found very satisfactory. As a Responsible Party, CEA have a Letter of Agreement (LOA) with UNDP.

## EVALUATION APPROACH AND METHOD

An overall approach and method<sup>1</sup> for conducting project terminal evaluations of UNDP supported GEF financed projects has developed over time. The evaluation should include a mixed methodology of document review, interviews, and observations from project site visits, at minimum, and the evaluators should make an effort to triangulate information. The evaluator is expected to frame the evaluation effort using the criteria of **relevance, effectiveness, efficiency, sustainability, and impact**, as defined and explained in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects (<http://web.undp.org/evaluation/documents/guidance/GEF/UNDP-GEF-TE-Guide.pdf>). A set of questions covering each of these criteria have been drafted and are included with this TOR. The evaluator is expected to amend, complete and submit this matrix as part of an evaluation inception report, and shall include it as an annex to the final report.

The evaluation must provide evidence-based information that is credible, reliable and useful. The evaluator is expected to follow a participatory and consultative approach ensuring close engagement with government counterparts, in particular the GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Adviser based in the region, project partner, sub-contractors and key stakeholders. Interviews will be held with the following organizations and individuals at a minimum: Ministry of Environment and Forests (MoEF), Ministry of Planning, Ministry of Industries, Sustainable and Renewable Energy Development Authority (SREDA), Housing and Building Research Institute (HBRI), Bangladesh Bank (BB), Bangladesh Auto Bricks Manufacturers Association (BABMA), Bangladesh Brick Manufacturer Owners Association (BBMOA), relevant NGOs and Research Organizations, workers in the manufacturing industries, and the users (e.g. Local Government Engineering Department, Public Works Department, real estate companies).

The evaluator will review all relevant sources of information, such as the project document, project reports – including Annual APR/PIR, project budget revisions, midterm review, progress reports, GEF focal area tracking tools, project files, national strategic and legal documents, and any other materials that the evaluator considers useful for this evidence-based assessment. A list of documents that the project team will provide to the evaluator for review is included in [Annex B](#) of this Terms of Reference.

## EVALUATION CRITERIA & RATINGS

An assessment of project performance will be carried out, based against expectations set out in the Project Logical Framework/Results Framework ([Annex A](#)), which provides performance and impact indicators for project implementation along with their corresponding means of verification. The evaluation will at a minimum cover the criteria of: **relevance, effectiveness, efficiency, sustainability and impact**. Ratings must be provided on the following performance criteria. The completed table must be included in the evaluation executive summary. The obligatory rating scales are included in [Annex D](#).

<b>Evaluation Ratings:</b>			
<b>1. Monitoring and Evaluation</b>	<i>rating</i>	<b>2. IA &amp; EA Execution</b>	<i>rating</i>
M&E design at entry		Quality of UNDP Implementation – Implementing agency	
M&E Plan Implementation		Quality of Execution - Executing Agency(EA)	
Overall quality of M&E		Overall quality of Implementation /Execution	
<b>3. Assessment of Outcomes</b>	<i>rating</i>	<b>4. Sustainability</b>	<i>rating</i>
Relevance		Financial resources	
Effectiveness		Socio-political	
Efficiency		Institutional framework and governance	
Overall Project Outcome rating		Environmental	
		Overall likelihood of sustainability	

## PROJECT FINANCE/COFINANCE

The Evaluation will assess the key financial aspects of the project, including the extent of co-financing planned and realized. Project cost and funding data will be required, including annual expenditures. Variances between planned and actual expenditures will need to be assessed and explained. Results from recent financial audits, as available, should be taken into consideration. The evaluator(s) will receive assistance from the Country Office (CO) and Project Team to obtain financial data in order to complete the co-financing table below, which will be included in the terminal evaluation report.

Co-financing (type/source)	UNDP own financing (mill. USD)		Government (mill. USD)		Partner Agency (mill. USD)		Total (mill. USD)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Grants	0	0	0	0	0	0	0	0
Loans/Concessions								
In-kind support								
Other								
Totals								

## MAINSTREAMING

UNDP supported GEF financed projects are key components in UNDP country programming, as well as regional and global programmes. The evaluation will assess the extent to which the project successfully mainstreamed other UNDP priorities, including enhanced carrying capacity of the environment and natural resource base and increased access to sustainable energy services resulting human and income poverty reduction, improved governance, the prevention and recovery from natural disasters, and gender. The evaluation will examine the project's contribution to the United Nations Development Assistance Framework (UNDAF).

## IMPACT

The evaluators will assess the extent to which the project is achieving impacts or progressing towards the achievement of impacts. Key findings that should be brought out in the evaluations include whether the project has demonstrated: a) verifiable improvements in ecological status, b) verifiable reductions in stress on ecological systems, and/or c) demonstrated progress towards these impact achievements.<sup>2</sup>

## CONCLUSIONS, RECOMMENDATIONS & LESSONS

The evaluation report must include a chapter providing a set of **conclusions, recommendations** and **lessons**. Conclusion should build on findings and be based in evidence. Recommendations should be prioritized, specific, relevant, and targeted, with suggested implementers of the recommendations. Lessons should have wider applicability to other initiatives across the region, the area of intervention, and for the future.

## IMPLEMENTATION ARRANGEMENTS

The principal responsibility for managing this evaluation resides with the UNDP CO in Bangladesh. The UNDP CO will contract the evaluators and ensure the timely provision of per diems and travel arrangements within the country for the evaluation team. The Project Team will be responsible for liaising with the Evaluators team to set up stakeholder interviews, arrange field visits, coordinate with the Government etc.

## EVALUATION TIMEFRAME

The total duration of the evaluation will be 36 working days over a period of 10 weeks

according to the following plan:

Activity	Timing	Completion Date
<b>Preparation</b>	4 working days	Second week of May, 2016
<b>Evaluation Mission</b>	15 working days	First and Second week of June, 2016
<b>Draft Evaluation Report</b>	10 working days	Third and Fourth week of June, 2016
<b>Final Report</b>	7 working days	Third week of July, 2016

## EVALUATION DELIVERABLES

The evaluation team is expected to deliver the following:

Deliverable	Content	Timing	Responsibilities
<b>Inception Report</b>	Evaluator provides clarifications on timing and method	No later than 2 weeks before the evaluation mission.	Evaluator submits to UNDP CO
<b>Presentation</b>	Initial Findings	End of evaluation mission	To project management, Project Board, UNDP CO
<b>Draft Final Report</b>	Full report, (per annexed template) with annexes	Within 2 weeks of the evaluation mission	Sent to CO, reviewed by RTA, PCU, GEF OFPs
<b>Final Report*</b>	Revised report	Within 1 week of receiving UNDP comments on draft	Sent to CO for uploading to UNDP ERC.

## EVALUATOR ETHICS

Evaluation consultants will be held to the highest ethical standards and are required to sign a Code of Conduct (Annex E) upon acceptance of the assignment. UNDP evaluations are conducted in accordance with the principles outlined in the [UNEG 'Ethical Guidelines for Evaluations'](#)

## APPENDIX B – MEETING SCHEDULE DURING MISSION (8-18, AUGUST 2016)

7 – 18 August 2016, Dhaka		
Day Date	1st Half of the day	2nd Half of the day
	Project Stakeholder/Organization to meet,	Project Stakeholder/Organization to meet
Sunday 7 August	<b>Arrival in Dhaka at 1630 hrs by Jet Airways flt 9W272</b>	
Monday 8 August	Briefing meeting with Project team at UNDP, IDB Bhaban	Briefing with ACD and Project Team on project and review of mission schedule
Tuesday 9 August	Participation in ADB and MOEF workshop on	Mandatory security briefing by UNDSS  Meeting with former IKEBMI project manager Mr. Amanullah Bin Mahmood
Wednesday 10 August	Meeting with PMID	Meeting with ADB  Meeting with BUET, Dr. Zia
Thursday 11 August	Meeting with BELA	Meeting with BUET, Dr. Shoukat
Friday & Saturday 12- 13 August	Open day.  Review documents, reports, CDR for IKEBMI	Meeting with Mr. Dulal, Secretary, BABMA
Sunday 14 August	Site visit to Universal Bricks Limited and ECO Bricks Limited, Aamtola Bazar, Dhamrai District	
Monday 15 August	National Holiday ** Worked on debriefing presentation at UNDP office	Meeting with Aman, UNESCO (former PM IKEBMI)
Tuesday 16 August	Meeting with Keystone consultant	Meeting with Bangladesh Bank
Wednesday 17 August	Meeting with WB  Meeting with SREDA	Debriefing at UNDP country office
Thursday 18 August	Meeting with HBRI	TE International Consultant departs Dhaka for New Delhi, via Kolkata

Total number of meetings conducted: 16

## APPENDIX C – LIST OF PERSONS INTERVIEWED

This is a listing of persons contacted in Bangladesh (unless otherwise noted) during the Terminal Evaluation mission.

- 1) Mr. Khurshid Alam, Assistant Country Director, UNDP, Dhaka
- 2) Mr. Arif Mohammad Faisal, Programme Specialist (Environmental Sustainability & Energy), Climate Change, Environment and Resilience (CCER) Cluster, UNDP Dhaka
- 3) Md. Rezaul Haque, Programme Associate, UNDP, Dhaka
- 4) Md. Amanullah Bin Mahmood, Project Officer-Science, UNESCO (former IKEBMI Project Manager)
- 5) Ms. Mayeesha Azhar, Research Assistant, Climate Change, Environment and Resilience (CCER) Cluster
- 6) Md. Solaiman Haider, Director Planning, Department of Environment
- 7) Mr Rafiqul Islam Khan, Managing Partner, Ms. Naheed Sultana and Mr. M.Ahad Participatory Management Initiative for Development (PMID)
- 8) Md. Abu Sumon, Interim Project Officer – IKEBMI project (March – June 2016)
- 9) Mr. Nazmul Alam, Project Officer, Financial Sector, ADB Bangladesh Resident Mission
- 10) Prof. Md. Ziaur Rahman Khan and Prof. Md. Ali Ahammad Shoukat Choudhury, Bangladesh University of Engineering & Technology (BUET)
- 11) Ms. Syeda Rizwana Hasan, Team Leader and A.M.M. Mamum, Research Assistant, Bangladesh Environmental Lawyers Association
- 12) Dr. B.N. Dulal, Chairman, First Auto Bricks Limited and Secretary Bangladesh Auto Brick Manufacturers Association (BABMA)
- 13) Mr Kabir, Factory Manager, Universal Bricks Limited and Mr. Sujit, Accounts Manager, Eco bricks Limited
- 14) Md. Fouzul Kobir Khan, Emeritus Advisor, Keystone Business Support Company
- 15) Mr. Munjurul Hannan Khan, Project Director, (WB CASE project) Department of Environment,
- 16) Md. Zainul Abeden, Deputy Director, and Ms. Tahmeed, Joint Director Green Banking and CSR Department, Bangladesh Bank
- 17) Dr. M. Khaliqzaman, Environmental Scientist and Dr. Istiak Sobhan, Natural Resource Consultant, The World Bank
- 18) Dr.Golam Faruque, Director (Administration), SREDA
- 19) Mr. Akhter Hussain Sarker, Senior Research Officer and Md. Abdus Salam, Senior Research Engineer, Housing and Building Research Institute

## APPENDIX D – LIST OF DOCUMENTS REVIEWED

1. IKEBMI – PDF B Phase – Terminal Report (May 2007)
2. Project Document
3. IKEBMI – Project Inception report (April 2011)
4. Project Implementation Reports
5. Combined Delivery Report (CDR)
6. Quarterly Progress Reports for years 2011 to 2014
7. Minutes of 1<sup>st</sup> National Steering Committee Meeting
8. Minutes of Technical Advisory Committee (1<sup>st</sup> and 2<sup>nd</sup>)
9. Project Implementation Reports (PIR)
10. Annual Result reports for year 2011, 2012, 2013, 2014
11. Terminal report PDF B
12. IKEBMI Mid-Term review report
13. Socio-economic baseline study on brick Manufacturing Industry of Bangladesh – Centre for Natural Resource Studies (June 2012)
14. Socio-economic profile, Profitability and Replication Study on HHK Demonstration plants – Md. Hisham Uddin Chisty
15. “Gender in Focus: Piloting Gender Support in Energy Efficient Brick Kiln” Global Gender and Climate Alliance
16. Report on ‘Review for Advocacy of Brick Manufacturing and Brick Kiln Setting (Control) Act 2013 – prepared by Bangladesh Environmental Law Association
17. Report prepared by BUET on ‘Comprehensive Study on the Present Status, Performance Barriers and Prospects of HHK Operating in Bangladesh (April 2016)
18. Training Needs Assessment Report and Assignment completion and Training Report on ‘Occupational Health and Safety, and Gender’ for Brick Kiln Workers – PMID (July 2016)
19. Participatory Agreement between Bangladesh Bank and NRB Bank limited under ADB supported ‘Financing Brick Kiln Efficiency Improvement’ project
20. HBRI newsletter – December 2014 edition
21. ADB mid-term review report of loan for ‘Financing Brick Kiln Efficiency Improvement Project’
22. . World Bank Bangladesh report on ‘Introducing Energy-efficient Clean Technologies in the Brick Sector of Bangladesh’ – Report No 60155-BD (June 2011)
23. Final Report on Environmental Impact Assessment of 2 x (500-660) MW Coal based Thermal Power Plant to be constructed in Khulna
24. IKEBMI audio-visual clips prepared by the project (on YouTube)
25. Awareness campaign material and proceedings of event held in:
  - a. Barisal division
  - b. Rangpur
  - c. Mymensingh
  - d. Cox’s Bazar



## APPENDIX E – COMPLETED TRACKING TOOL

Special Notes: reporting on lifetime emissions avoided		
<b>Lifetime direct GHG emissions avoided:</b> Lifetime direct GHG emissions avoided are the emissions reductions attributable to the investments made during the project's supervised <a href="#">Manual for Energy Efficiency and Renewable Energy Projects</a> <a href="#">Manual for Transportation Projects</a> For LULUCF projects, the definitions of "lifetime direct and indirect" apply. Lifetime length is defined to be 20 years, unless a different number of years is deemed appropriate. For emission or		
General Data	Results at Terminal Evaluation	Notes
Project Title	Improving Kiln Efficiency in Brick Making Industries	
GEF ID	1901	
Agency Project ID	75326	
Country	Bangladesh	
Region	SAR	
GEF Agency	UNDP	
Date of Council/CEO Approval	October 16, 2009	Month DD, YYYY (e.g., May 12, 2010)
GEF Grant (US\$)	3,000,000	
Date of submission of the tracking tool	October 27, 2016	Month DD, YYYY (e.g., May 12, 2010)
Is the project consistent with the priorities identified in National Communications, Technology Needs Assessment, or other Enabling Activities under the UNFCCC?	1	Yes = 1, No = 0
Is the project linked to carbon finance?	0	Yes = 1, No = 0
Cumulative cofinancing realized (US\$)	80,621,901	
Cumulative additional resources mobilized (US\$)	77,400,000	additional resources means beyond the cofinancing committed at CEO endorsement
Objective 2: Energy Efficiency		
Please specify if the project targets any of the following areas		
Lighting	0	Yes = 1, No = 0
Appliances (white goods)	0	Yes = 1, No = 0
Equipment	0	Yes = 1, No = 0
Cook stoves	0	Yes = 1, No = 0
Existing building	0	Yes = 1, No = 0
New building	0	Yes = 1, No = 0
Industrial processes	1	Yes = 1, No = 0
Synergy with phase-out of ozone depleting substances	0	Yes = 1, No = 0
Other (please specify)		
Policy and regulatory framework	4	0: not an objective/component 1: no policy/regulation/strategy in place 2: policy/regulation/strategy discussed and proposed 3: policy/regulation/strategy proposed but not adopted 4: policy/regulation/strategy adopted but not enforced 5: policy/regulation/strategy enforced
Establishment of financial facilities (e.g., credit lines, risk guarantees, revolving funds)	5	0: not an objective/component 1: no facility in place 2: facilities discussed and proposed 3: facilities proposed but not operationalized/funded 4: facilities operationalized/funded but have no demand 5: facilities operationalized/funded and have sufficient demand
Capacity building	4	0: not an objective/component 1: no capacity built 2: information disseminated/awareness raised 3: training delivered 4: institutional/human capacity strengthened 5: institutional/human capacity utilized and sustained
Lifetime energy saved	14,800	TJ (Terajoule, IEA unit converter: <a href="http://www.iea.org/stats/unit.asp">http://www.iea.org/stats/unit.asp</a> ) Fuel savings should be converted to energy savings by using the net calorific value of the specific fuel. These energy savings are then totaled over the respective lifetime of the investments.
Lifetime direct GHG emissions avoided	639,740	tonnes CO <sub>2</sub> e (see Special Notes above)
Lifetime direct post-project GHG emissions avoided	-	tonnes CO <sub>2</sub> e (see Special Notes above)
Lifetime indirect GHG emissions avoided (bottom-up)	8,224,321	tonnes CO <sub>2</sub> e (see Special Notes above)
Lifetime indirect GHG emissions avoided (top-down)	1,644,864	tonnes CO <sub>2</sub> e (see Special Notes above)
Objective 6: Enabling Activities		
Please specify the number of Enabling Activities for the project (for a multiple country project, please put the number of countries/assessments)		
National Communication		
Technology Needs Assessment		
Nationally Appropriate Mitigation Actions		
Other		
Does the project include Measurement, Reporting and Verification (MRV) activities?	0	Yes = 1, No = 0

## APPENDIX F – EVALUATION QUESTION MATRIX

Evaluative Criteria	Questions	Indicators	Sources <sup>25</sup>	Methodology <sup>26</sup>
<b>Relevance: How does the project relate to the main objectives of the GEF focal area, and to the environment and development priorities at the local, regional and national levels?</b>				
<ul style="list-style-type: none"> <li>Is the project relevant to National priorities and commitment under international conventions? <i>Yes, the project is highly relevant to the steadily growing bricking making sector of Bangladesh. Interventions made by IKEBMI were timely for influencing the investment in energy efficient HHK for brick making and helped to reduce the growth rate of GHG emissions from this particular sector.</i></li> </ul>	<ul style="list-style-type: none"> <li>Was the project consistent with the main objectives of GEF focal area? <i>The project's aim is to introduce energy efficient technology in brick making to reduce the consumption of fossil fuel (coal) and thereby reduce GHG emissions. The project is aligned with GEF-Operational Program 5 which has the objective to reduce net GHG from anthropogenic sources.</i></li> </ul>	Project deliverables	Project document, Key project partners, Annual progress report	Document review and interview with stakeholders
	<ul style="list-style-type: none"> <li>Was the project aligned with new brick manufacturing and brick kiln act of the country? <i>The project was developed in 2006 based on the successful outcome of PDF-B project. It was aligned with Government of Bangladesh's "Brick Burning (Control) Act 1989 and its amendments of 1992 and 2001. The project provided inputs to the government for "Brick Manufacturing and Brick Kiln Establishment (Control) Act, 2013".</i></li> </ul>	Project deliverables	Project document, PIR, Annual Progress reports	Document review
	<ul style="list-style-type: none"> <li>Was the project consistent with the main objectives and key priorities of the government and other stakeholders? <i>Yes, as stated above.</i></li> </ul>	-	Annual Progress reports	Document review
<ul style="list-style-type: none"> <li>Is the project internally coherent in its design?</li> </ul>	<ul style="list-style-type: none"> <li>Are there logical linkages between expected results of the project (log frame) and the project design (in terms of project components, choice of partners, structure, delivery mechanism, scope, budget, use of resources etc.)?</li> </ul>	-	Project document, annual report, PIR	Document review, data analysis, interview with project stakeholders

<sup>25</sup> Various sources, but not limited to project document, project reports, national policies & strategies, key project partners & stakeholders, needs assessment studies, data collected throughout monitoring and evaluation, data reported in project annual & quarterly reports etc.

<sup>26</sup> Various methodologies, but not limited to Data analysis, Documents analysis, Interviews with project team, Interviews with relevant stakeholders etc.

	<p><i>There are logical linkages between targets of the various outputs. However, there are couple of end-of-project targets (success indicators) that are very ambitious, not with-in the control of the project therefore not easy to measure. The project planning matrix (log frame) has few indicators that were not SMART.</i></p>			
	<ul style="list-style-type: none"> <li>Did the project made satisfactory accomplishment in achieving project outputs vis-à-vis the targets and related delivery of inputs and activities? <i>Yes, the main outcome of reducing the GHG emissions from brick making sector through reduction in specific energy consumption has been satisfactorily accomplished with the introduction of HHK, awareness creation, capacity building, financing of new brick kiln by PFI and government ministries and departments.</i></li> </ul>	Project deliverable	Site visit, meeting with stakeholders, analysis of GHG emission data	Document review
<ul style="list-style-type: none"> <li>Does the project provide relevant lessons and experiences for other similar projects in the future? <i>Yes.</i></li> </ul>	<ul style="list-style-type: none"> <li>Has the experience of the project provided relevant lessons for other future projects targeted at similar objectives? State the lessons learnt. <i>Please refer to Section 4 of the report.</i></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review
<b>Effectiveness: The extent to which an objective has been achieved or how likely it is to be achieved?</b>				
<ul style="list-style-type: none"> <li>Has the project been effective in achieving the expected outcomes and objectives? <i>Yes. The project has met the objective of reducing the GHG emission from brick sector, and has achieved the outcomes.</i></li> </ul>	<ul style="list-style-type: none"> <li>To what extent did the project reduce GHG emission from demonstrations compared to business as usual scenario? <i>Compared to business as usual scenario, the IKEBMI project has helped to reduce 597,090 tonnes of CO2 emission, which the main contributor to GHG emission from the brick sector. Also refer table 3 and Appendix E.</i></li> <li>To what extent did the brick making companies submitting reports to BBMOA/SEDA? <i>Currently brick making is an informal sector with private sector operators. It is not a formally recognized as an industry therefore the sector does not have 'information disclosure' requirements.</i></li> <li>To what extent did the project enhance awareness of the public and other stakeholders on EEKs, EE molding practices and EEK brick products?? <i>The project substantially improved public awareness through the campaigns it organized in the divisions of Barisal, Mymensingh, Rangpur and Cox's bazar, which also involved sensitizing the division level</i></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review

	<a href="#"><i>government officials about EEK and environmental issues associated with FCK including use of top-soil and biomass as fuel.</i></a>			
<ul style="list-style-type: none"> <li>How is risk and risk mitigation being managed?</li> </ul>	<ul style="list-style-type: none"> <li>How well are risks, assumptions and impact drivers being managed? <a href="#"><i>The action taken by PIU satisfactorily dealt with the risks during project implementation phase. Towards the EOP the rating of all possible risk remains 'low'.</i></a></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review
	<ul style="list-style-type: none"> <li>What was the quality of risk mitigation strategies developed? Were these sufficient? <a href="#"><i>The project document has a section on Project risks and Assumptions which has considered 5 major risk factors – lack of government support, lower adoption rate of EEK, technology risk, financial risk and market risk (external factor), which may affect the project. The risk framework did not factor 'Political risk' as Bangladesh faced some political unrest in 2012 and 2013, which reduces the pace at which project activities are being implemented.</i></a></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review
	<ul style="list-style-type: none"> <li>Are there clear strategies for risk mitigation related with long-term sustainability of the project? <a href="#"><i>The risk mitigation proposed in the framework were adequate to ensure the project implementation and its long-term sustainability.</i></a></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review
<ul style="list-style-type: none"> <li>Consideration of recommendations and reporting of information</li> </ul>	<ul style="list-style-type: none"> <li>Did the project consider Midterm Review recommendations conducted in 2014 and reflected in the subsequent project activities? <a href="#"><i>Yes. The project followed and implemented the recommendations provided during the Midterm review.</i></a></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review
<b>Efficiency: Was the project implemented efficiently, in-line with international and national norms and standards and delivered results with the least costly resources possible?</b>				
<ul style="list-style-type: none"> <li>Was project support provided in an efficient way?</li> </ul>	<ul style="list-style-type: none"> <li>To what extent were project resources used to maximize the results obtained? <a href="#"><i>The project resources were fully utilized to achieve various outcome results and overall project goal.</i></a></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review

<p><i>The project was managed as Directly executed project of UNDP in which five outcomes were managed jointly by CEA and XIAN, while one outcome was managed by UNDP.</i></p>	<ul style="list-style-type: none"> <li>What was the cumulative energy savings from brick kilns? <i>The estimated annual energy saving from 35 HHK is 2252.TJ. Also, Refer Appendix E for amount of energy saved from HHK brick units.</i></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review
	<p>What was the project’s contribution to reduced average energy cost per unit brick in the BMI? <i>The project demonstrated the HHK in brick making in which fuel (coal) consumption is half of traditional FCK which use BTK.</i></p>	Project deliverables	Site visit, meeting with stakeholders	Document review
<ul style="list-style-type: none"> <li>How efficient are partnership arrangements for the project?</li> </ul>	<ul style="list-style-type: none"> <li>To what extent did the project improve local vocational, technical, and managerial capacity to manage and sustain operations of EEKs and EE practices? <i>The project partner XIAN, which provided the HHK technology and assisted in setting up of brick units using this technology, also provided technical training for the operation of the kiln.</i></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review
	<ul style="list-style-type: none"> <li>Was there an effective collaboration between institutions responsible for implementing the project? <i>The project achieving nearly all its main goal demonstrate effective collaboration between project partners and institutions involved in implementation of project activities.</i></li> </ul>	Project deliverables	Site visit, meeting with stakeholders	Document review
<p>Sustainability: To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?</p>				
<ul style="list-style-type: none"> <li>Will the project be sustainable on its conclusion and stimulate replications and its potential? <i>The IKEBMI project has generated sufficient momentum through awareness and engagement of key project stakeholders – brick manufacturer association, department of environment,</i></li> </ul>	<p>To what extent did demonstration EEK technology application projects become operational and sustainable? <i>The project supported 5 demonstration projects using HHK technology for brick making of which 3 are operational and two could not progress due to non-completion of civil construction work.</i></p> <p>To what extent is there availability of financial and institutional support to encourage SME adoption of energy efficient kilns? <i>Substantial amount of private finance has been utilized and additionally bank finance at low interest rate is currently being provided to entrepreneurs to invest in energy efficient kilns. Also, refer table 2 on commitment and expenditure by different donors.</i></p>	Project deliverables	Site visit, meeting with stakeholders	Document review

<p><u>and 52 banks and financial institution that have expressed interest in providing debt funding for EEK.on-going engagement of ADB and WB for improving efficiency in brick industry. With an active engagement of multiple stakeholders, the project will be sustainable provided government policies continue to put emphasis on energy efficient and environment friendly brick making process.</u></p>	<p>To what extent are stakeholders aware of the project's benefits and invested in sustaining the project results passed the project's closure date?</p> <p><u>A fairly large cross-section of the society was made aware of the project's benefit through the campaign, as well as through TV news coverage and information on YouTube. The key stakeholders such as government, brick mill owners, banks, academic institution, Civil Society Organisation and various consulting organizations got involved with IKEBMI project.</u></p>	Project deliverables	Site visit, meeting with stakeholders	Document review
	<p>To what extent are there institutional or governance barriers that might hinder the sustainability of project outcomes?</p> <p><u>The project, through multi-stakeholder engagement has been able to overcome the barriers that existed at the beginning. Government needs hand-holding support to frame guideline and amend 2013 Act to support conversion of traditional brick kilns into EEK.</u></p>	Project deliverables	Site visit, meeting with stakeholders	Document review
<p><b>Impact: Are there indications that the project has contributed to, or enabled progress towards maximizing environmental benefits?</b></p>				
<p>What was the project impact under different components?</p> <p><u>The project has created awareness among a wide cross-section of the society about the environmental benefits of energy efficient kiln and better working condition in an alternative brick making process. It has been instrumental in motivating entrepreneurs to invest in HHK brick making units and leveraged debt financing from PFI.</u></p>	<ul style="list-style-type: none"> <li>To what extent did the project enable brick makers to develop and implement EEK technology application and EC&amp;EE projects?</li> </ul> <p><u>The project's work on awareness creation about the environmental benefits of energy efficient kiln and better working condition in an alternative brick making process has brought about major shift in the brick making industry to look for an improved process.</u></p>	Project deliverables	Site visit, meeting with stakeholders	Document review
	<ul style="list-style-type: none"> <li>What was the additional co-financing amount that was leveraged by the project and mobilized investments in the brick making industry? The co-financing given by IIFDC and the investments made by individual Energy Efficient Kiln units.</li> </ul> <p><u>The project's direct technical assistance to 5 HHK based brick production units and awareness creation motivated private entrepreneurs to invest in HHK technology for brick production. The project leveraged addition co-financing of USD72.5million from entrepreneurs in 20 HHK based brick making units which are operational before EOP.</u></p>	Project deliverables	Site visit, meeting with stakeholders	Document review

<p>What are the indirect benefits that can be attributed to the project?</p> <p><i><u>The project also indirectly influenced ADB's USD50 million line of credit to Bangladesh bank for providing debt finance for 'Brick kiln efficiency improvement'. The World Bank through its Clean Air and Sustainable Environment' (CASE) project has provided USD4.94million TA for Brick kilns emission management.</u></i></p>	<p>To what extent did the project enable the promulgation of and compliance to regulations that encourage adoption of energy efficient kilns ?</p> <p><i><u>The project interacted with officials in the Ministry of Environment and Forest as well as with government officials at the division during awareness creation campaigns provided. The project shared information about the efficient brick making process and experience from five HHK based brick kilns that were operation. These inputs from IKEBMI project as well as World Bank's CASE project were used by the government in formulating "Brick Manufacturing and Brick Kiln Establishment (Control) Act, 2013".</u></i></p>	Project deliverables	Site visit, meeting with stakeholders	Document review
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## APPENDIX G – PROJECT PLANNING MATRIX

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
<b>GOAL:</b> Reduction of the growth of GHG emissions from the brick making industry (BMI) in Bangladesh.	GHG emissions reduced by 314 ktonnes CO <sub>2</sub> (direct) from 16 EEK demonstration projects compared to business-as-usual scenario by end of project (EOP).	Documentation of energy savings and GHG emissions reduction from demonstration projects BERM Program reports	GHG emission reductions of 314 ktonnes achieved by the end of IKEBMI based (1,470 ktonnes after 15-years) on the use of 13 tonnes per 100,000 HHK-sized bricks from 16 HHK plants
<b>PURPOSE:</b> Removal of barriers that inhibit the adoption of energy efficient kilns and molding techniques by the BMI	Cumulative energy savings from brick kilns by about 3,326 TJ or 130 ktonnes coal by EOP About 2.2% of the brick (including expected replications) produced in Bangladesh are from EEKs by EOP Average energy cost per unit brick in the BMI is reduced by 1.2% by EOP.	Documentation of energy savings and GHG emissions reduction from demonstration projects BERM Program reports Survey of brick makers	Based on new data from HHK demonstrations (using 13 tonnes per 100,000 HHK-sized bricks), cumulative energy savings can be 3326 TJ or 130 ktonnes of coal The direct impact of HHKs is 2.2% of all brick kilns. A 5.5% target assumes a replication factor of >1.0. Targets assume that the growth rate of brick kilns is 5.28% annually
<b>OUTCOMES</b>			
<b>Component 1: EEK Technology Support Program</b>  Thorough understanding and appreciation of technology options and their environmental impacts by brick makers, government and other stakeholders	About 1.1% improvement in the overall specific energy consumption in the BMI by EOP One completed comparative study on competing technologies on brick making in Bangladesh by Year 1 Clay resources assessed and sources identified for 15 HHK demos by EOP Annual operating performance of 16 HHKs evaluated by EOP Annual reports submitted on incorporating improvements on energy performance of each HHK starting Year 1. Energy reporting system developed and used to report on energy performance for 16 HHK demos starting Year 1. Database developed for light	Documentation of energy savings and GHG emissions reduction from demonstration projects BERM Program reports (brick maker reports and BBMOA/SEDA feedback reports) Documentation of EC&EE projects influenced by the pilot demonstrations under the IKEBMI project Activity reports	A 1.1% improvement in specific energy consumption is more reasonable (based on the project's 16 HHKs and a 5.28% growth rate of FCKs over the project period) Brick makers are willing and interested in participating and cooperating in the design, development and implementation of the BERM program  Relevant information are made available



Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
<p><b>Component 2: EEK Demonstration Program</b></p> <p>Establishment of a critical mass of demonstration projects that will provide detailed information of EEK operations, energy savings and environmental impacts to interested brick makers</p>	<p>engineering and consultancy services in the vicinity of the 16 HHK demos starting Year 2.</p> <p><math>4.0 \times 10^{-6}</math> T.J/brick energy consumption for bricks produced in EEKs EOP</p> <p>20 consultations each year with potential HHK investors and entrepreneurs by EOP starting Year 1</p> <p>15 HHK technical feasibility studies by EOP.</p> <p>15 reports on implementation requirements for HHK demos by EOP</p> <p>15 surveys of baseline brick production and coal consumption by EOP</p> <p>15 final designs of HHK plants by EOP</p> <p>Financial closure for 15 HHK demos by EOP</p> <p>Successful construction and commissioning of 15 HHK demos by EOP</p> <p>16 demonstration HHK technology application projects established and operational by EOP</p> <p>100 participants in dissemination seminar</p>	<p>Documentation of demonstration project operations (including reports on plant visits)</p> <p>Plant coal usage records and tests for the calorific value of coal used</p> <p>IKEBMI Project M&amp;E reports</p> <p>Database of potential entrepreneurs and investors</p> <p>Completed technical feasibility and implementation studies</p> <p>Baseline survey reports</p> <p>Final design packages for HHK demos</p> <p>Construction and commissioning reports</p> <p>Documents for financial closure of HHK demos</p> <p>Number of participants in dissemination seminar</p>	<p>Demonstration projects are fully financially supported by their host companies</p> <p>Host demo sites allow visitors to visit and/or study the demo project</p>
<p><b>Component 3: EEK Technical and Management Capacity Building Program</b></p> <p>Improved local vocational, technical, and managerial capacity to manage and sustain operations of EEKs and EE practices in Bangladesh</p>	<p>500 production personnel trained and certified in vocational aspects of brick making starting Year 4.</p> <p>Assessment completed of capabilities of light engineering services with a 10 km radius of the 16 HHK demo projects by Year 4</p> <p>5 advisory discussions at each of the 16 HHK demos on improving local engineering services by EOP</p> <p>Feasibility study on standardization of brick kiln and associated equipment by</p>	<p>Training strategy, course materials and training reports</p> <p>Assessment reports on light engineering capabilities</p> <p>Records of advisory discussion with light engineering service providers</p> <p>Feasibility studies.</p> <p>IKEBMI Project M&amp;E reports</p> <p>Documentation of certified brick production personnel by relevant certifying body.</p>	<p>BMI SMEs are willing to adopt new business methods to adopt cleaner and energy efficient technologies</p> <p>Relevant information are made available</p> <p>Relevant personnel are interested and willing to participate in the training and in applying the knowledge/know-how they learn</p> <p>GoB, private sector investors, and international donors are willing to provide financial support for specific EC&amp;EE projects in the BMI.</p>

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
	Year 3 Over 50 participants annually successfully complete training course on design, feasibility evaluation, construction and O&M for HHKs 30 entrepreneurs provided with technical assistance to plan HHKs by EOP	Notes on discussions with entrepreneurs on planning HHKs	
<b>Component 4: Communications and Awareness Program</b>  Enhanced awareness of the public and other stakeholders on EEKs, EE molding practices and EEK brick products	50 visitors annually to the BMI Information Centre each year starting Year 3 More than 20% of BMI members surveyed have positive attitudes towards HHKs and/or EEKs 500 hits annually on BMI website 10 newspapers covering workshop and media events by EOP	Guest book list BMI website BMI awareness surveys indicating positive attitudes towards EEKs Feedback communications from clients of Information Center	Relevant stakeholders and target groups are interested in participating and cooperating in the design, development and implementation of program
<b>Component 5: EEK Finance Support Program</b>  Availability of financial and institutional support to encourage SME adoption of energy efficient kilns:	Action plan prepared for financing HHK demos for Year 1 Techno-economic feasibility studies of 15 HHK demos by EOP Officers from 10 different financial institutions engaged in HHK investments discussions by EOP Linkages between 15 Entrepreneurs and 5 banks by EOP At least 50% of financial institutions funding HHKs offers concessional loan by EOP At least 16 HHKs registered for CDM revenues by EOP	Action plan for financing HHK demos Techno-economic feasibility studies Records of discussions with finance institutions offering loan/credit facilities for HHK projects Documentation of business links Circulars of green funds Registration of HHKs with CDM project	Relevant information about local companies are made available, including data on annual revenues and profits Full cooperation of survey respondents is ensured.
<b>Component 6: EEK Policy Development and Institutional Support Program</b>  Promulgation of and compliance to regulations that encourage adoption of	About 2.2% of brick production in Bangladesh is compliant to set emission standards for brick kiln operations by Year 3. 30 participants at 2 seminars on EEK regulatory regimes by Year 3 and 4	Seminar proceedings Documentation of the policies and implementing rules and regulations for the BMI Documentation of brick quality	Re-target emission compliance to 2.2% of all brick production in Bangladesh - this is the direct impact and does not include replication beyond the 16 demo HHKs due to anticipated capital constraints

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
energy efficient kilns:	Policies and IRRs for the BMI drafted by Year 4 Draft brick quality standards by Year 3 Drafting of BMI EE policy by Year 4 25 participants in each of the 3 national policy implementation and enforcement workshops Strategies and regulations on minimizing land degradation from BMI activities are developed and implemented by Year 2 Desk study of EE policy for BMI submitted in Year 5 100 persons attending regional workshops on BMI emission standards	standards Documentation of strategies and regulations on the sustainable use of clay resources Workshop proceedings Report on EE policy for BMI Workshop proceedings and report on environmental battery limits	Implementing rules and regulations are enforced Continued GoB support for favorable regulatory regime throughout the project life

## APPENDIX H– EVALUATION CONSULTANT AGREEMENT FORM

### Signed Copies of EVALUATION CONSULTANT CODE OF CONDUCT AND AGREEMENT FORM

#### Evaluators:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

#### Evaluation Consultant Agreement Form<sup>6</sup>

##### Agreement to abide by the Code of Conduct for Evaluation in the UN System

**Name of Consultant:** Mr. Sandeep Tandon, TE International Consultant

**Name of Consultancy Organization** (where relevant): Not Applicable

**I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.**

Signed at place on date: July 31, 2016, NOIDA, U.P., India

Signature: 