GLOBAL ENVIRONMENT FACILITY
EVALUATION OFFICE

OPS4 Technical Document # 3:

The Catalytic Role of the GEF

Case Study: Energy Conservation and GHG Emissions Reduction in Chinese Township and Village Enterprises in China

Prepared by

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Undertaking such a challenging work is our honor but at the same time a good opportunity for capacity building. While this study benefited from the knowledge, viewpoints and experiences of those many different individuals, the final responsibility for the report remains with NCSTE.

The Case Study Team/evaluation of GEF Catalytic Role Evaluation

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June 19, 2009

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Abstract

In June 2006, the Council of Global Environment Facility (GEF) approved an evaluation of the GEF catalytic role. The catalytic role of the GEF is reflected in the GEF Operational Strategy (OS, 1994) as one of ten Operational Principles for the development and implementation of the GEF Work Program. In its more recent work of the Fourth Overall Performance Study (OPS4), the GEF Evaluation Office has further explored the catalytic nature of the GEF activities.

In 2008, "The Evaluation of the GEF Catalytic Role: Case Study of Energy Conservation and GHG Emission Reduction in Chinese Township and Village Enterprises (TVEs)" was funded by the GEF Evaluation Office and implemented by the study team of the National Center for Science and Technology Evaluation of China (NCSTE).

As there is no agreed definition of catalytic effects, several evaluations conducted by the GEF Evaluation Office have pointed to difficulties in implementing and assessing the principle of catalytic role. Phase 1 of the evaluation has therefore focused on methodology to develop a conceptual framework for the catalytic role in the GEF focal areas. The Evaluation Office is now conducting this evaluation (Phase 2) to better understand the relationship between its catalytic role and the attainment of global environmental benefits.

The objective of the evaluation is to explore how the GEF conceptualizes and implements its catalytic role to maximize global environmental benefits. Phase 2 consists of field work case study to test the framework and gather findings and lessons learned on application of the GEF catalytic role and emerging effects. The findings of the field work will be reflected in the Fourth Overall Performance Study (OPS4) in China.

The main findings of the final evaluation report and the conclusions drawn from the evaluation stand to prove that the TVE project has been very successfully implemented, with unexpectedly greater GHG reduction achieved and remarkable demonstration and replication results scored, leaving behind a strong sustainability legacy. Moreover, based on the main findings, the TVE project seems to be very suitable for UNDP/UNIDO and GEF promotion as a world best practice project in the rural industry/SME sector because it has proved sound sustainability and impact.

During the evaluation, the study team has used the tools of desk review, interviews and workshops, field visits, questionnaire survey and cross-cutting analysis methods to analyze the results of GEF catalytic role in China.

Regarding to the limitations of the project evaluation, the rate of returned questionnaires (about 23%) and the quality of responses were not as high as desired. Moreover, due to time restriction and resource limit, the evaluation did not conduct field visits to all of the four sectors and pilot/demonstration enterprises. The team only carried out four field visits in the sectors of brick and cement. Therefore, the study on the sector of coking and metal-casting were only based on desk reviews.

The evaluation report consists of six chapters, including the contents of 1) Background and Purpose; 2) Project Description and Policy Evolvement; 3) Conceptual Framework and Methodology; 4) Catalytic Foundation; 5) Catalytic Activity; and 6) Key Findings and Recommendations.

As described in Chapter 6, the key findings and recommendations are related to the following issues: 1) Key catalytic factors in the case study, including selection of appropriate technology, strong support from government, market demand and flexibility of funding; 2) Verification of the classification of GEF catalytic role strategy; 3) Recommendations for improving the GEF conceptual framework, namely, improving the GEF conceptual framework of climate change project (with China case study's contribution to the supplement of GEF conceptual framework for climate change project), the study approach to GEF catalytic role evaluation in the future and the tracking of self-replication activity in the future.

In conclusion, undertaking such a challenging work is our honor but at same time a good opportunity for capacity building. While this study benefited from the knowledge, viewpoints and experiences of these many different individuals, the final responsibility for the report remains with China National Center for Science and Technology Evaluation (NCSTE), the People's Republic of China.

Abbreviations

ABC	Agricultural Bank of China
CO_2	Carbon Dioxide
EE	Energy Efficiency
GEF	Global Environment Facility
GHG	Greenhouse Gas
GOC	Government of China
LPIC	Local Policy Implementation Committee
MOA	Ministry of Agriculture
MOF	Ministry of Finance
NDRC	National Development and Reform Commission
NGO	Nongovernmental Organization
PIC	Policy Implementation Committee
PMO	Project Management Office
PTPMC	Production Technology and Product Marketing Consortium
RCF	Revolving Capital Fund
RMB	Ren Min Bi (Chinese currency)
SMEs	Small and Medium-size Enterprises
TCE	Tons of Coal Equivalent
TVEs	Township-Village Enterprises
UNIDO	United Nations Industry Development Organization
UNDP	United Nations Development Programme
VA	Voluntary Agreement (between government, TVEs and relevant industry associations)

Contents

1. Background and Purpose

In June 2006, the Council of Global Environment Facility (GEF) approved an evaluation of the GEF's catalytic role. The catalytic role of the GEF is reflected in the GEF Operational Strategy (OS, 1994) as one of ten Operational Principles for the development and implementation of the GEF Work Program.

There is no agreed definition of catalytic effects. Several evaluations conducted by the GEF Evaluation Office have pointed to difficulties in implementing and assessing the principle of catalytic role. Phase 1 of the evaluation has therefore focused on methodology to develop a conceptual framework for the catalytic role in the GEF focal areas (See Figure 2 – Conceptual Framework of Climate Change Projects).

However, it implies that, given the limited amount of money available for projects, the GEF hopes to design projects in such a way so as to attract additional resources, pursue strategies that have a greater result than the project itself, and/or accelerate a process of development or change.

The Evaluation Office is conducting this evaluation (Phase 2) to better understand the relationship between its catalytic role and the attainment of global environmental benefits. The objective of the evaluation is to explore how the GEF conceptualizes and implements its catalytic role to maximize global environmental benefits. Phase 2 consists of field work case studies to test the framework and gather findings and lessons learned on application of the GEF catalytic role and emerging effects. The findings of the field work will be reflected in the Fourth Overall Performance Study (OPS4).

The overall evaluation of the GEF catalytic role addresses the following questions:

- How does the GEF conceptualize its catalytic role?
- How can the catalytic role be measured?
- How does the GEF operationalize its catalytic role?
- What is the effect of different strategies used for promoting catalytic effects?
- To what extent is the GEF catalytic?

China presents a good opportunity for field work for the evaluation. An exploratory mission by the Evaluation Office to China in September 2007 found that a possible case study was welcomed by the Chinese authorities, and identified several possible options for case study (within industrial energy efficiency, renewable energy, and natural reserves). In addition, China presents useful lessons learned from other completed projects (such as the fridge/light bulb projects) that can be used for related desk reviews for the overall catalytic role evaluation.

In particular, China may present an interesting case, because of its large potential and scale for catalytic effects and scaling-up; the broad range of the portfolio with a

considerable number of closed projects; several projects with explicit objectives of scaling-up and replication; and the government policies and commitment to demonstration pilots and replication. Also of high importance in China are the notions of seed money; links to central policy change; and national ownership.

The GEF Evaluation Office therefore selected the Energy Conservation and GHG Emissions Reduction in Chinese Township and Village Enterprises (TVEs) (GEF ID 263 & 622, agency UNDP) as a case study because of the linkages the project design (and evaluations) makes between catalysis and the attainment of global environmental benefits.

The project has potential to yield findings and lessons, which could inform the future development of GEF interventions in the focal area of climate change. It falls within the GEF-4 priority of Energy Efficiency in Industry (OP5) in climate change. The project strategies cover all the strategies identified in the preliminary conceptual framework including information on replication, demonstration, capacity building, policy, funding, and markets. It closed in 2007, with a terminal evaluation in July 2007, and can therefore provide up-to-date information.

2. Project Description and Policy Evolvement

2.1 Project Description

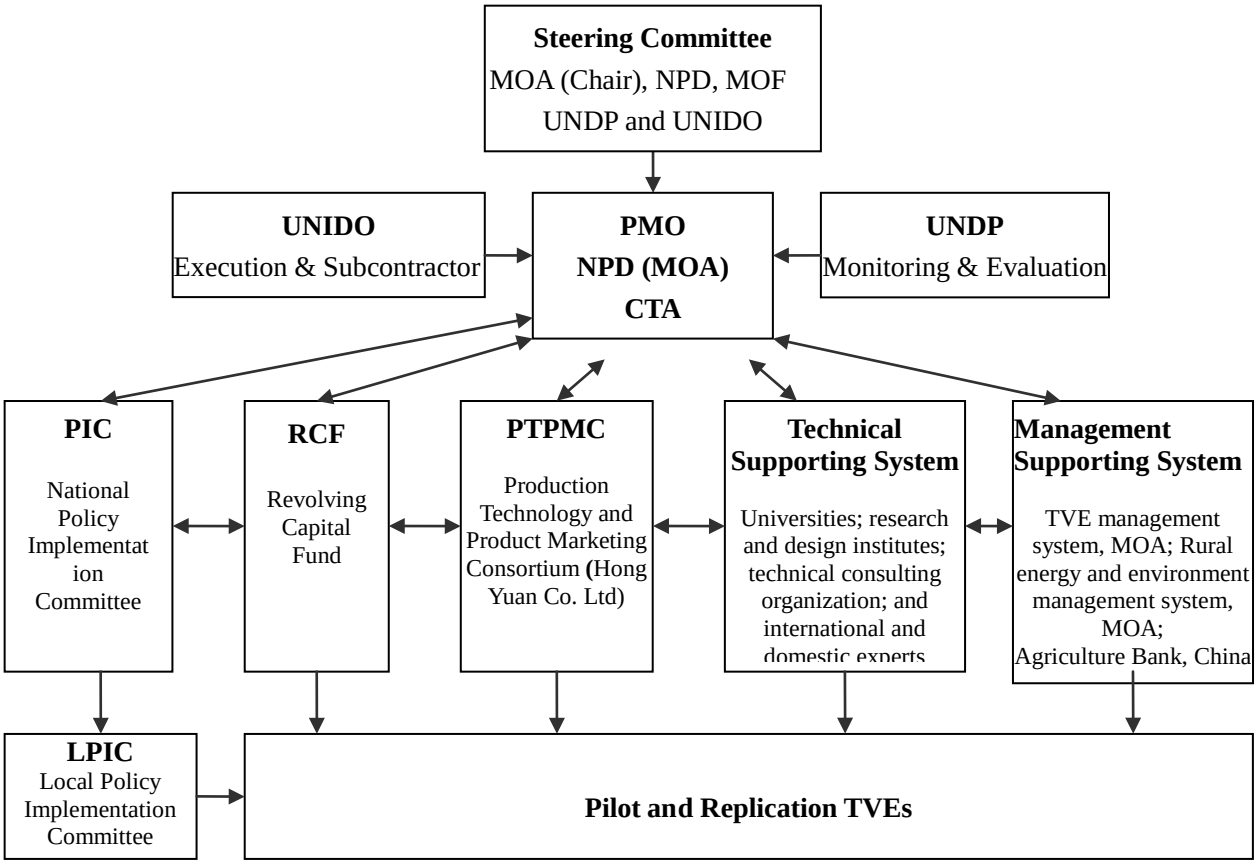
China's township and village enterprises (TVEs) came into being in the 1950s, as rural, collectively owned entities were established at the township and village level as a strategic component of the development of the rural economy. Since China adopted the policy of reform and opening–up in the late 1970s, the emerging TVEs have contributed a significant share to China's economic growth and social welfare and become one of the major forces in promoting China's rural economy and national development. There are around 23 million TVEs in China, accounting for about 30% of GDP and providing 143 million primarily unskilled rural jobs.

However, despite their general momentum and growth, the development of TVEs were limited by insufficient investment, policy support, outdated technologies and poor management, which resulted in very low energy efficiency and caused severe environment pollution. These problems have been more severe in such sectors as brick making, cement, coking and metal casting, because these four TVE sectors account for one-sixth of China's CO_2 emissions.

The Energy Conservation and GHG Emission Reduction in Chinese Township and Village Enterprises project (hereinafter referred to as the TVE project) was launched in February 2001. The project had its funding approved by GEF in May 1999 and was supported by a GEF grant of $7.992 million, with planned domestic co-financing (in-kind and in-cash) of $10.55 million, for a duration of four years.

UNDP was the international Implementing Agency; UNIDO was the international Executing Agency; and the Ministry of Agriculture (MOA) was the domestic Executing Agency. Project Management Office (PMO) was established in MOA in January 2001 and was responsible for related organizing and implementation work (see Figure 1).

Figure 1 Institutional Arrangement for Project Management and Implementation



The aim of this project was to reduce greenhouse gas emission in China TVEs in the sectors of brick, cement, coking and metal casting by increasing the utilization of energy efficient technology and product, and establishing mechanism to remove key market, policy, technological and financial barriers, promoting TVEs' sustainable development. The overall objectives of the project included:

1) creating institutional mechanisms for barrier removal at the national, county and enterprise levels;
2) establishing incentives and monitoring systems to strengthen existing regulatory programs at the county level;
3) building technical capacity for energy efficiency and product quality

improvement in TVEs;

4) creating special access to commercial financing for TVEs in industries in the four sectors to undertake energy conservation and GHG emission reduction activities;
5) commercializing the financing of TVE energy conservation projects;
6) expanding the application of best practices for local regulatory reform to the national level.

To overcome the barriers related to inadequate policies, techniques, markets and financing, the TVE project was designed to undertake pilot projects in eight enterprises in the four industry sectors, and to undertake feasibility studies and detailed designs to underpin the duplication of the subsequent pilot project successes to at least 100 enterprises in 20 counties (out of a total of 2861 county level administrations in China).

The framework for overcoming the barriers comprised of Policy Implementation Committees (PICs) at national and local levels, a Production Technology and Product Marketing Consortium (PTPMC), and a Revolving Capital Fund (RCF). The first step in building the barrier removal framework was for the project to establish barrier removal institutions covering eight pilot counties. The institutions were designed to show the benefits of barrier removal in general by demonstrating how barriers could be removed in real-world applications in rural China. Then, based on the pilot experiences, the proven successful institutional structures and development approaches were to be replicated, expanded nationally, or absorbed into existing national and/or local institutions.

Box 1 Output/Outcome of the TVE Project

According to the main findings of the final evaluation report, the TVE project has been very successfully implemented, has achieved far greater than anticipated GHG reduction and remarkable results in demonstration and replication, and leaves a strong sustainability legacy.

In the eight pilot-demonstration projects implemented, a GHG reduction of 193,192 tons CO_2/yr has been achieved compared with the 85,000 tons/yr CO_2 reduction anticipated in the project's design. Around $49 million of co-funding was invested in these pilots, including $10 million from commercial sources, leveraged by an $800,000 contribution from GEF.

In addition, 111 out of 118 GEF formal replication (or planed-replication) projects have achieved a total CO_2 reduction of 1.3 million tons/yr, with funding provided by GEF, the TVEs' investment, as well as a range of grants, policies and other support from various levels of the Chinese government. GEF's $2 million contribution has leveraged around $100 million of co-funding in these replication projects.

Furthermore the project has clearly fostered a considerable number of independent energy efficiency self-replications that have been implemented without direct project funding support. These self-replications were facilitated by the extensive technical training provided by the project, as well as the site visits and training provided by the pilot TVEs. The project's pilot and formal replication results also built up the interest in energy efficiency, let alone the project publicity efforts, and the technology dissemination efforts made by the Local Policy Implementation Committees (LPICs). All of the above contributed to the emergence of these

self-replications.

Moreover，based on the TE findings, the TVE project seemed to be very suitable for UNDP/UNIDO and GEF promotion as a world best practice project in the rural industry/SME sector because it has proved sound sustainability and impact.

Source: Terminal Evaluation Report (June 2007).

2.2 Policy Evolvement

In the past two decades, China has experienced a rapid growth of GDP, which however has been primarily driven by high consumption of energy and resource and has caused widespread environmental pollution. For example, China's total amount of energy consumption in 2007 reached 2.65 billion tce[1] and CO_2 emissions from energy consumption in 2004 totaled 5.07 billion tons.[2]

Tackling with the severe environmental problems and trying to realize its commitment to international community, the Government of China (GOC) has attached great importance to the policy issues of energy conversation and pollution control and a series of strategy, regulation and law were published, with the aim to improve energy efficiency and decrease the carbon dioxide emissions. The implementation of the TVE project has also benefited from these policy mandates.

More recently, energy conservation and emission reduction is placed in a more prominent position. The State Council has set up a leading group, which is chaired by Premier Wen Jiabao, responsible for coordinating the national task of energy conservation and emission reduction. In October 2008, the State Council issued China's Policies and Actions for Addressing Climate Change which will further enhance China's actions to tackle the challenge of climate change.

Box 2 gives a brief summary of the main policy development of Chinese central government in the field of energy conservation and emission reduction.

Box 2 Chinese Policy Evolvement

- In the early 1980s, the Chinese government started to pay attention to energy conservation and several administrative regulations were published. But these orders were mainly related to the saving of electricity or saving of petroleum and were not so much closely linked to the issue of emission reduction.
- In January 1998, China started to implement the Energy Conservation Law. By the end of

[1] National Bureau of Statistics of China, Statistical Communiqué of the People's Republic of China on the 2007, February 28, 2008.

[2] Information Office of the State Council of the People's Republic of China, China's Policies and Actions for Addressing Climate Change, October 2008, Beijing.

2002, China has already enacted 25 laws and regulations on energy conservation and environmental protection.

- In June 2004, China's Medium and Long Term Energy Development Plan Outline (2004-2020) was approved, which incorporated energy development planning into the overall planning of social-economic development. In November that year, the National Development and Reform Commission set the long-term goals for energy consumption reduction: to reduce China's energy consumption per RMB 10,000 GDP from 2.68 tce in 2002 to 2.25 tce in 2010, and to 1.54 tce in 2020.
- In March 2006, the Chinese government promulgated the outline of the 11th Five-Year Plan for National Economic and Social Development which projected that the per-unit GDP energy consumption by 2010 will be reduced by around 20% compared to the year of 2005, and the total amount of major pollutants discharged will be reduced by 10%. It is the first time that the central government included energy consumption index into national development targets.
- In June 2007, the State Council issued the General Work Plan for Energy Conservation and Pollutant Discharge Reduction, which announced a timetable for different areas to close down their backward production facilities in 13 industries during the latest Five-year Plan period. For example, the year 2007 saw the stoppage of more than 2,000 heavily polluting papermaking plants, chemical plants, and printing and dyeing mills.
- In June 2007, the National Plan for Coping with Climate Change set the following objectives that will be met by 2010: policies and measures concerning control of greenhouse gas emissions should achieve significant results, the capability of adaptation to climate change should be relentlessly enhanced, and climate-change-related R&D should be promoted. In addition, the public awareness of the importance of addressing climate change should be emphasized, and the institutions and mechanisms for dealing with climate change should be further strengthened.

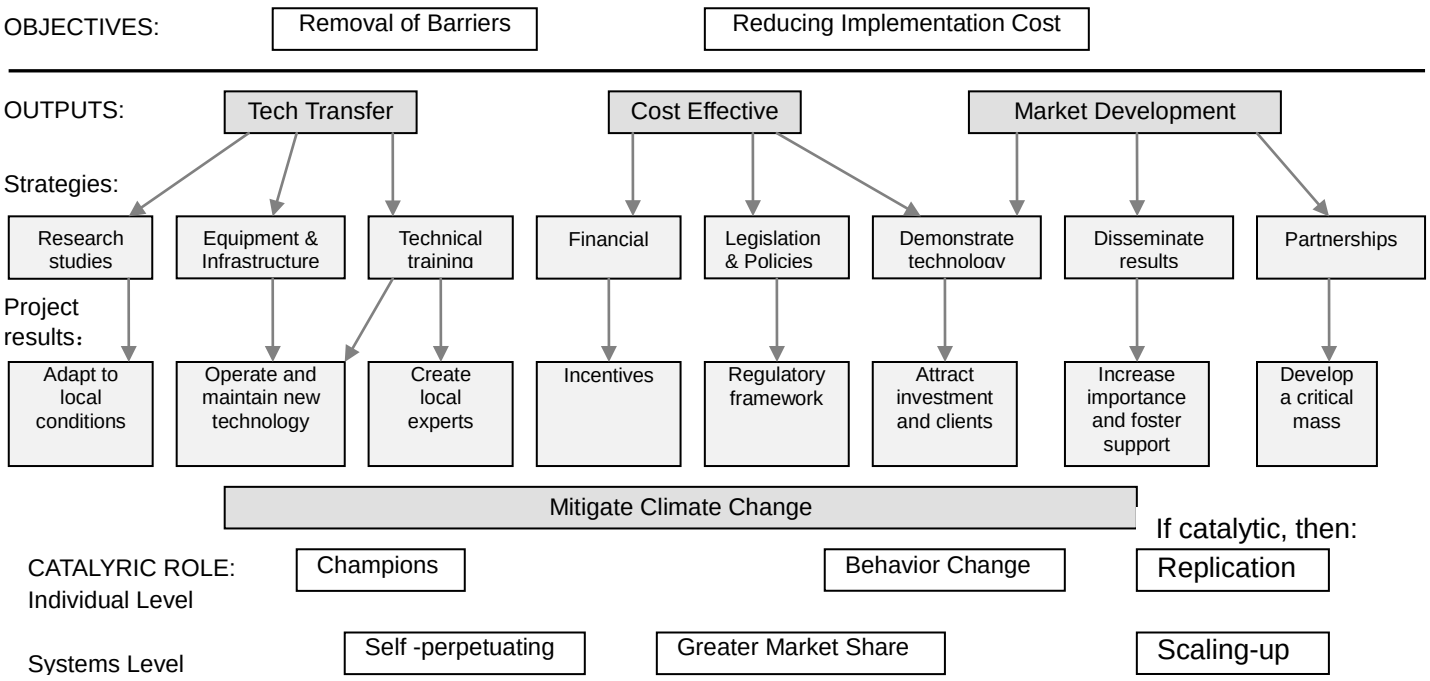
Source: Desk Research of Chinese Policy, Regulation and Law.

3. Conceptual Framework and Methodology

3.1 Conceptual Framework

In September 2007, the GEF Evaluation Office prepared the technical paper *A Qualitative Analysis of Terminal Evaluations* (prepared by Avery Ouellette) which developed conceptual frameworks by focal area (See Figure 2 - Conceptual Framework for Climate Change Projects).

Figure 2 Conceptual Framework for Climate Change Projects



According to the preliminary findings of the conceptual framework study, the strategies to promote GEF's catalytic role used in projects could be divided into three general categories:

1) Foundation – these strategies consisted of awareness building and capacity building, and laid the groundwork for more significant project strategies.

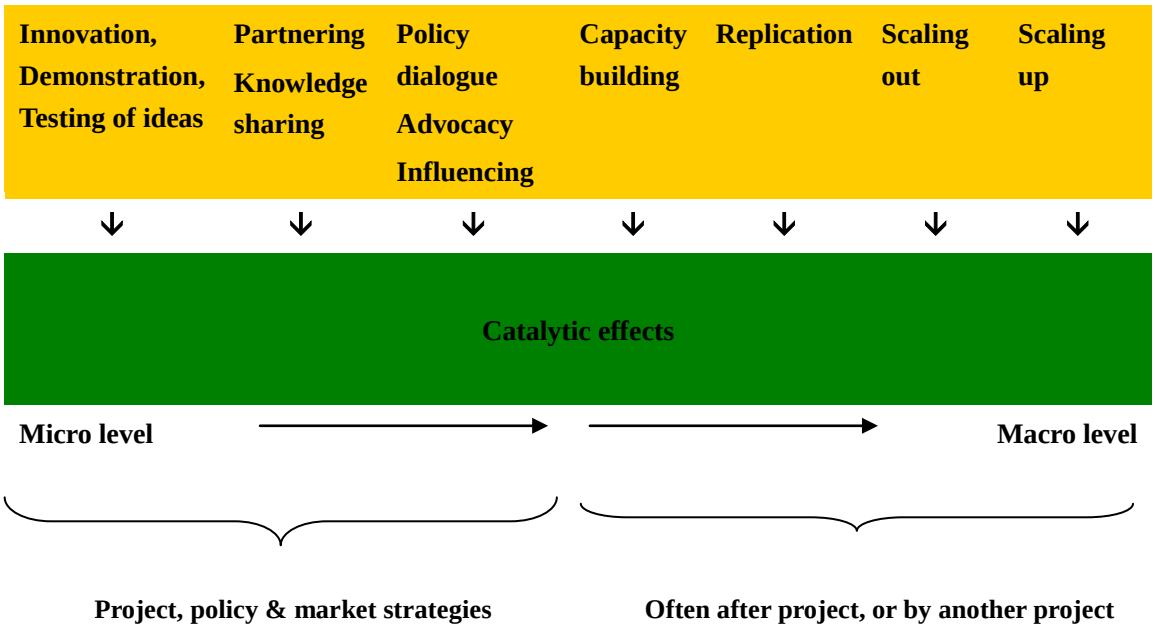
2) Momentum – these strategies, ranging from creating markets to demonstration of techniques or technology, represented the core focus of the project.

3) Expand – these strategies consisted of replication and scaling up of the project components and tended to increase the scale of the project results.

In November 2008, the GEF Evaluation Office provided the evaluation team the revised draft concept report of the *Evaluation of the GEF Catalytic Role: Conceptual Framework* and more concrete "issues for field work" as a reference to guide country case studies. In this paper, although the concept of 'catalyst,' 'catalysis' and 'catalytic role' are discussed, the catalytic concept and terms are still hinted or implicitly associated with activities or process that may trigger or generate 'catalytic effect.'

However, the evaluation team of the China case study thought that a possible chain of catalytic activities illustrated in the paper can be considered as a useful tool to help analyze the catalytic effect of the country case (See Figure 3).

Figure 3 A Possible Chain of Catalytic Efforts



According to the analysis of the Evaluation Office, a catalytic process may be seen as a chain of activities (called catalytic efforts), in which different actors intervene at different times and with different immediate goals to further the results. Not all interventions go through each stage. While a catalytic element can be present at each stage; there seems to be agreement that a 'catalytic effect' often takes place somewhere at the end of one's intervention – and at the beginning of someone else's intervention, moving from the micro to the macro level. This corresponds generally to the results chain of outputs, outcomes and impact.

When analyzing the catalytic role of GEF projects, this evaluation took reference of the above conceptual framework of climate change projects and incorporated the characteristics of China's situation as well as the nature of the TVE project itself. Moreover, the suitability of the conceptual framework and the strategies for GEF catalysis were tested through the evaluation.

In its more recent work for OPS4, the Evaluation Office has further explored the catalytic nature of the GEF. Analysis point towards three broad categories of GEF activities: (1) "foundational" and enabling activities, focusing on the policy, regulatory frameworks and national priority setting and relevant capacity; (2) medium-size and full-size projects and the Small Grants Programme, which focus on demonstration, capacity development, innovation, and market barrier removal; and (3) full-size projects with high rates of cofunding, catalyzing investments or implementing a new strategic approach at a national level. Activities may be carried out in a phased approach: first foundational, second demonstration, and third investment activities.

The three categories approach combines all the necessary elements that have been

shown to catalyze to results in international cooperation. For example, activities at the micro-level of skills transfer, piloting new technologies and demonstrating new approaches, need support at the institutional or market level to succeed. Furthermore, institutional capacity development or market interventions on a larger scale need the support of governmental laws, regulatory frameworks and policies to be sustainable.

3.2 Evaluation Methodology

According to the TOR (See Annex E TOR), the objective of the evaluation was to identify activities during and after project implementation which have potential catalytic results. The China case study also aimed to test and validate the conceptual framework for climate change projects; and gather findings and lessons learned on the application of the GEF catalytic role. In assessing catalytic effects, a mix of complementary methods was employed in this evaluation, such as desk study, interviews and workshops, field visits, questionnaire survey and cross-cutting analysis.

1-Desk Study

In the desk study stage, the evaluation team collected basic information, data and documents of the TVE project with special focus on the information which is related to catalytic roles or effects. The background information was reviewed and analyzed, including the project summary, project mid-term and final evaluation reports, project meeting minutes and the project news from the internet **(**See Annex D. Documents Reviewed/Reference). Moreover, Chinese policy information related to climate change issues was studied.

2-Interviews and Workshops

On the basis of the desk study, evaluators conducted several interviews to key stakeholders at national level and sector level, including the meetings with the China GEF Office and Central PMO of the Ministry of Agriculture. Different stakeholder workshops were held during the field visit missions. Representatives of pilot/demonstration and replication enterprises, industry association and local government were invited to participate in these workshops. Evaluators designed a set of key questions/checklist and collected additional information from the stakeholders (See Annex C. Field Visit/Workshop Checklist). In total, the evaluation carried out eight interviews and workshops.

3-Field Visit

According to the TOR, four pilot/demonstration projects were selected for on-site visits in the sectors of cement and brick (See Table 1 Location of Replication Enterprises in Four Sectors). There are two important reasons for the selection: firstly, the number of TVEs in those two sectors (80 projects) accounts for nearly two thirds of the total formal replication TVEs in China (118 projects); secondly,

according to a pre-desk reviews, projects in these two sectors had intended or more likely seemed to have more self-replication cases. Thus, the tracking of the self-replication and scaling-up activities would seem possible in this evaluation.

From July to September 2008, the evaluation team and experts went to four provinces to visit the four TVE projects which were among the eight pilot/demonstration projects, i.e., Xi'an Liucun Hollow Brick Plant (Shaanxi Province), Xinjin Yongxing Shale Brick Company Ltd. (Sichuan Province), Zhejiang Shenhe Cement Co. Ltd. (Zhejiang Province) and Baojiang Cement Material Co. Ltd. (Guangdong Province).

Field visits were considered as a primary activity of the evaluation with focus on collecting useful information about the mechanism, approaches, output and outcome of catalytic effects. During the field trips, key evaluation questions were checked with project managers, technicians and local government officials as well as other stakeholders (See Annex B Case Study Mission Report; Annex D. Field Visit/Workshop Checklist).

Table 1 Location of Planned-Replication Enterprises in Four Sectors

Sub-sectors	Location of Provinces														Total
	Hebei	Guangdong	Henan	Zhejiang	Fujian	Jiangsu	Jilin	Jiangxi	Chonggqin	Tianjin	Shanxi	Sichuan	Liaoning	Shaanxi	
Brick												15	16	29	60
Cement	1	3	2	7	2	2	1	1	1						20
Coking											7				7
Casting						6				7	10		8		31
Sub-total	1	3	2	7	2	8	1	1	1	7	17	15	24	29	118

Source: Project Document.

4-Questionnaire Survey

The Chinese TVE project has built eight pilot TVEs and supported 118 replication TVEs. Considering the field visit only covered four of them, a uniform questionnaire was designed and sent to 200 pilot, replication and self-replication enterprises in order to obtain their opinions and attitudes regarding GEF catalytic role. With 46 (or 23% return rate) returned questionnaires, evaluators analyzed statistically these information and used them as additional tool for comprehensive analysis (See Annex B. Questionnaire).

5-Cross-cutting Analysis

On the basis of the conceptual framework of the GEF catalytic role, the evaluators

firstly classified and analyzed the project data and information which are the results of the desk study. Then the opinions collected from interviews, stakeholder workshops and surveys were analyzed. Moreover, the facts that were checked from field visits were included into the sources of information and the analysis. Therefore, the cross-cutting analysis can be regarded as a 'triangulation' model.

In the process of cross-cutting analysis, the important evidence concerning the key issues or questions listed in the TOR was cross-verified from different information sources. For example, the same questions were given to project managers, local government officials and others during stakeholder workshops and in the questionnaire. The evaluation team then compared their observations during the field visits and made a judgment of the fact. To ensure the accuracy and reliability of the key findings and conclusions, the team paid special attention to make a distinction between findings related to facts and those related to opinions.

When the information was triangulated and analyzed and in order to draw main findings and conclusions, the following questions were addressed and focused: (1) How is catalysis defined and what is its nature? (2) How are certain strategies, or combination of strategies, used in the projects to foster catalysis? (3) What features of a project are more likely to trigger catalysis than others? (4) What is the effect and/or impact of the GEF catalytic role? (5) How can the main mechanisms used by the GEF to facilitate its catalytic role be identified?

3.3 Limitation of Evaluation

The review of project documents showed that the information of the eight pilot/demonstration projects and 118 replication projects were well recorded. However, the Mid-term Evaluation Report and Final Independent Evaluation Report mentioned that the data of self-replication results was absent because the project design did not require such monitoring of the self-replication activities. Also, the evaluation team could not be able to re-collect this kind of data comprehensively. As an alternative, the team collected some information about the self-replication at sector and region level from the project management offices (PMO), LPICs as well as through the questionnaire survey.

Furthermore, the rate of returned questionnaires (23%) and the quality of responses were not as high as desired. Hence, the use of questionnaire was limited.

Moreover, due to time restrictions and resource limits, the evaluation did not conduct field visits to all of the four sectors and pilot/demonstration enterprises. The team only carried out four field visits in the sectors of brick and cement. Therefore, the study on the sectors of coking and metal-casting were only based on desk reviews.

4. Catalytic Foundation

4.1 The Nature of the Project

In the design of the Chinese TVE project, the GEF catalytic role was not explicitly mentioned, but the activities of demonstration, replication and scaling up were included from the beginning of the project. These activities were closely related to the concept of GEF catalytic role.

As mentioned in 2.1 Project Description, one of the objectives of the TVE project at design was to create institutional mechanisms for barrier removal at the national, county and enterprise levels. To overcome the barriers related to policies, techniques, markets and financing, the project was designed to undertake pilot projects in eight enterprises in the four industry sectors, and duplicating the subsequent pilot project results to 118 enterprises in 14 provinces. During the Mid-term and Terminal Evaluations, the 'barrier removal' activities were assessed. Take 'replication' as an example. Based on the desk review of this evaluation and the compiled information from Mid-term and Terminal Evaluations, Table 2 summarizes the main activities of replication which was primarily designed as 'Outcome Indicator 5'.

Table 2 Summary of Replication Indicators and the Related Activities

Outcome Indicator at Design Stage	Project Strategy at Design Stage	Main Activities that had been Implemented
Replication facilitated by: a) Institutionalizing a commercial intermediary mechanism for the financing of energy conservation and product improvement project within the four TVE sectors on a nation-wide scale; b) Recommending to policy makers best practices for the improvement and enforcement of relevant laws in the county level for national implementation.	Main strategies: a) Replication of best practices; b) Replication of pilot plant technologies	● Identification and implementation of LPIC Action Plans ● Survey and identification of the pilot project technologies ● Capacity building of eight pilot TVEs ● Replication of pilot project mechanisms ● Replication of pilot plant technologies ● Replication through trainings and workshops ● Completed technical feasibility studies on replicated plants ● Self-replication activities implemented

Sources: Project Document, Mid-term and Terminal Evaluation Reports.

As the table shows, the nature of the project at design and implementation envisaged that the pilots/demonstrations and replications would be the most important elements which would help in stimulating or triggering catalytic effects. Therefore, in this

chapter and the following chapters, the evaluation will take this ‘nature’ or characteristic into consideration when analyzing the facts and evidence that cause catalytic role.

4.2 Catalytic Foundation

In chemistry a catalytic reaction happens when a necessary catalyst is added and suitable condition or foundation is met. For example, the reaction requires proper temperature and a period of time to complete its process. Based on the conceptual framework, one of the catalytic strategies of GEF project implementation is defined as ‘foundation’ which consists of awareness building and capacity building. In the evaluation of the Chinese TVE project, the study team found that additional groundwork, i.e. the selection of appropriate technology, could be considered as a foundational element which can support project catalytic strategies.

4.2.1 Awareness Building

When the project was started in May 1999, China as a whole had rather limited awareness about energy reservation and emission reduction. With China’s fast socio-economic development, more and more Chinese people – not just decision makers, scientist and experts, but also entrepreneurs and the wider public – have developed growing awareness of environmental issues, including climate change, and are content to make contributions to the improvement of local and global environmental conditions.

In fact, at the project design stage, the concept of ‘awareness and understanding of energy efficiency (EE) technologies’ was included in the key output indicators for direct project results. For example, the level of public acceptance of EE measures, the level of awareness and understanding of EE technologies, processes, services, and/or actions of the benefits of EE investments within the TVE industry were designed for monitoring and evaluation.

Through the demonstration and dissemination of the TVE project results, the TVE entrepreneurs realized that their investment in technical renovation could be valuable and their awareness has been therefore increased after they had experienced the replication process of the TVE project. Questionnaire results verify this improved awareness among the investigated entrepreneurs and show that 59% (27 out 46 project enterprises) of them considered their “awareness toward energy reservation and emission reduction have been very much increased” and 39% of them “increased” respectively.

Furthermore, the evaluation team found through field visits and workshops that the awareness building had a very wide range of content and deep involvement of stakeholders which represented the state and local governments, associations of

relevant industry sectors, financing organizations, research institutes, universities, private sector enterprises as well as NGOs. For stakeholders' behavior changes, see Table 3.

Table 3 The Result of Stakeholders' Awareness Building and Follow up Actions

Stakeholder	Awareness Change	Follow-up Action
Enterprises	Understood that introducing EE technical renovation and replication could save energy and bring benefit not only to themselves but also to the wide public	Continue technical renovation activities, including the investment in other energy programs and apply energy efficiency management
Governments	Changed their traditional view or bias towards TVEs, realized the important potential of TVEs energy savings and GHG reduction	Enact incentive policies and regulations including fund support and initiatively assist TVEs follow-up activities
Banks	Increased the confidence of granting loan to TVEs for energy saving and GHG reduction business	Open broader business market to TVEs for EE technical renovation
Sub-contractors	Realized broad market share of energy saving services, such as providing technology, equipment and consultancy	Develop new energy business domestically and abroad, explore the multiple energy service markets

Sources: Project Document, Interviews, Stakeholder Workshops and Field Visits.

In the TVE project, the Voluntary Agreement (VA) on energy reservation and GHG reduction was for the first time introduced in China. The use of formal co-operation Voluntary Agreements (VAs) between the TVE enterprises, local government agencies (through the LPICs), and relevant industry associations proved to be very effective in China's TVE sectors. The VAs facilitated tangible energy efficiency actions through a formal framework that coordinated global GHG objectives, national objectives and local environmental, and competitiveness objectives. The signing and the implementation of VA have proved that the Chinese TVE entrepreneurs have really realized the importance of energy reservation and GHG reduction and therefore their awareness have been greatly increased.

In conclusion, the awareness building proved to be a crucial foundation for catalysis. It not only played the key role during the project circle, but also had impact on society after the project ended.

4.2.2 Capacity Building

In the conceptual framework of climate change, there exist two types of capacity building: institutional capacity building and individual capacity building. The evaluation found that in the Chinese TVE project both institutional and individual capacity building was conducted by different stakeholders, regarding technical skill, management, coordination and financing.

According to the conceptual framework, the most frequently used institutional capacity building strategy is creating a new institution, typically government offices to promote and oversee the implementation of a new energy efficient technology. Coincided with this concept in the TVE project, the Policy Implementation Committee (PIC) and the Local Policy Implementation Committee (LPIC) mechanisms have played an important role in promoting the demonstration of EE technology and the replication.

During the project implementation, the central and local governments were cultivated with strong capacity of policy development. For example, as soon as Zhejiang Shenhe Cement Co. Ltd successfully finished the pilot project of power generation utilizing residual heat from the rotary kiln process, a preferential policy to promote and disseminate this practice had been issued by Zhejiang Provincial Authority. Later on, the new technique was effectively applied not only in Zhejiang Province but also in other provinces. Furthermore, in the Mid and Long-term National Energy Conservation Plan issued by National Development and Reform Commission (NDRC) in December 2004, this technology was on the list of encouraged techniques. Experts from the pilot TVE project were invited to involve in developing the relevant part of the NDRC national energy conservation plan.

During the stakeholder workshops and interviews, the evaluation team found that most of the stakeholders who have participated in this GEF project were satisfied with the results of individual capacity building. For example, although the TVE project was the first GEF project managed by the TVE PMO of MOA, the PMO emphasized at the start of project the great importance of individual capacity building of stakeholders, including PMO's own staff. Through practice, the PMO managers improved their management abilities in supervising international projects. Through a number of trainings organized by PIC and LPICs, as well as the on-site visits to pilot projects, the technical skills of the technicians and workers of the TVE replication enterprises were improved and enhanced. Moreover, partnerships among enterprises, associations and research institutes also played an important role in enhancing the capacity of knowledge sharing and EE technology transfer.

4.2.3 Technology Selection

The experience drawn from the Chinese TVE project showed that the selection of appropriate technology would be one of the key factors of the catalytic foundation because the appropriateness of technology could affect the achievement of the catalytic goal. When proper and practical technology was selected, it would be easier to successfully demonstrate the technology and then the replication could be introduced at a large scale. In selecting these renovation techniques for four sectors,

the PMO, research institutes and pilot enterprises worked closely to determine which technology would be a tailor-made one to suit China's situation. The evaluation also found that only the appropriate and applicable technology could attract entrepreneurs and then rapidly be adopted at regional or even national level.

In the cement, coking, brick and foundry sectors in China, the common feature is that the energy consumption is very high in all sectors but the ways to address their problems are distinct, especially from the technical point of view. Considering the rapid pace of changes in China during the project implementation, the proposed pilot/demonstration projects and technologies had to be adjusted, changed or updated. In the TVE project, the concept of "to realize GHG reduction from energy saving" was well accepted by the project management offices and other stakeholders. Enterprises were encouraged to apply technology and equipment with high performance and relatively low investment. For the purpose of energy saving, cement and coking enterprises usually needed larger investment and the applied technology was complex but unique in most cases. Compared with the above two sectors, the technical renovation in brick and foundry plants was rather easy to be conducted and with smaller investment. Table 4 below lists the major technologies selected and replicated by eight pilot projects.

Table 4 Demonstrated Technologies in TVE Project

Sector	Demonstrated Technologies
Cement	Turn mechanical shaft kiln to rotary kiln, 5 stage cyclone pre-heater waste heat recovery and power generation.
Coking	Clean-type coke oven, coking heat recovery and power generation
Brick	Tri-arch Hoffman kiln, Use of energy saving machines like kiln extraction fans, electric motor power factor correction machine, and the techniques to improve vacuum and reduce heat loss
Foundry	Thorough technical renovation like improvement of the casting machine, the process of metal melting and sand resin modeling, use of hot-air blast cupola and power factor correction machine

Sources: Project Document, Mid-term and Terminal Evaluation Report.

Furthermore, the case study envisages the fact that the right selection of cost-effective technology can help to enlarge the catalytic effect. Two examples give the evidence for this finding. In China, brick making plants are usually very small and their investments are limited. What they need are not complicated and advanced technologies but those that are practical, easy to operate and fast to get benefits. Small equipment like power factor correction machines and kiln extraction fans

demonstrated in the brick making sector was highly welcomed and adopted by entrepreneurs in the process of technical renovation because such equipment only cost 8,000 to 12,000 RMB (or around $1,000 to $1,500) per unit and the return of investment took only four to six months through the energy saving.

Different from brick industry, the investment of technology renovations in cement sector are relatively higher and risky. Therefore, the maturity and applicability of the applied technology are the great concern of the entrepreneurs. The Shenhe cement plant, as one of the pilot projects, introduced the technology of 5 stage cyclone pre-heater waste heat recovery and power generation in 2003. Although the total investment in the renovation cost more than 20 million RMB (or around $2.5 million, with $100,000 coming from the GEF), the plant got the investment returned in only 3 years from the sayings of energy and electricity. For quite a long time, cement entrepreneurs in Zhejiang Province had paid close attention to technology renovation, but most of them worried about the technical maturity and how much the cost would be. Once this successful case emerged, these entrepreneurs did not hesitate to join in the campaign of replication. They also took the same technology as the pilot demonstrated and even expanded the scale of technical renovation. This example explains why the replication in the TVE project was so prominent that more than expected catalytic results have been achieved.

5. Catalytic Activity

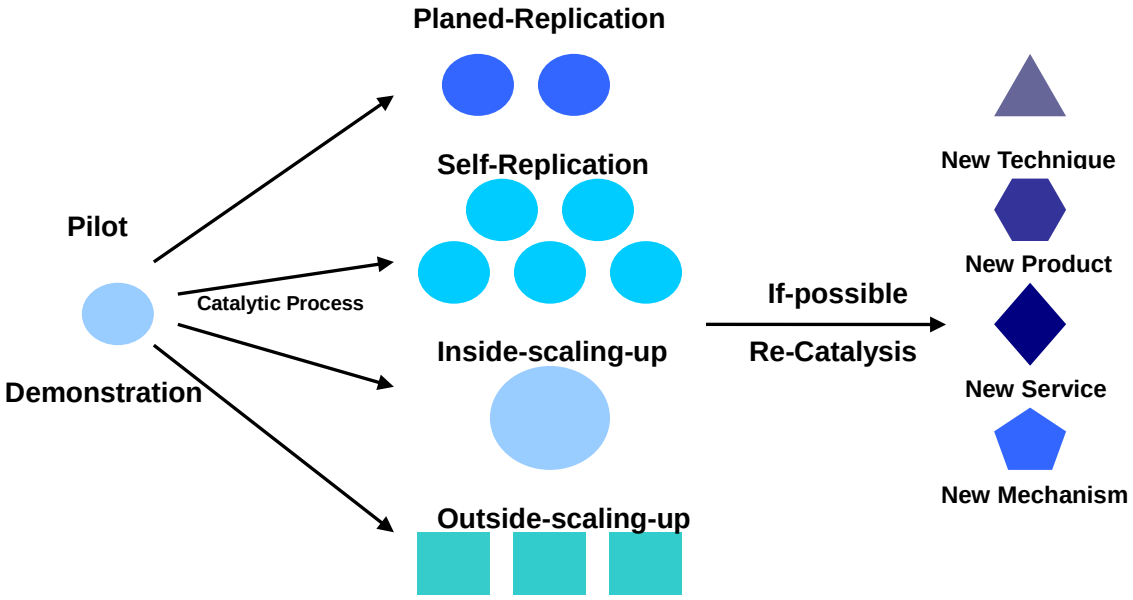
5.1 The Chain of the Catalytic Process

The process of catalysis is a chain of activities and process of interaction in which many stakeholders are involved. In this case study, catalytic activities focused on the pilot/demonstration, dissemination as well as replication activities at different levels. As mentioned in the conceptual framework of climate change projects, the dominant momentum strategy is demonstration, namely “catalysis through demonstration,” which was found common in climate change project design. This finding also emerged in the Chinese TVE project.

During the process of pilot/demonstration in the Chinese TVE project, the central and local governments, associations, project enterprises, supplier sub-contractors, as well as media worked together and the fruitful cooperation between stakeholders have accelerated the process of dissemination and replication of energy efficiency technologies at national and local level. More detailed analysis will be elaborated in this chapter and the following chapters, regarding the roles played by different catalytic actors in their activities at different levels.

Based on the fact and evidence collected, the evaluation team tried to summarize the chain of catalytic process as illustrated in Figure 4.

Figure 4 The Catalytic Process in the Chinese TVE Project



According to the previous study of GEF conceptual framework, the terms of replication and scaling-up were implicitly associated with catalysis but lacked a clear unified definition and the 'theory of change'. This made the catalytic concept more opaque. For example, the previous study indicated that catalysis concerns changes and is not necessarily related to the concept of replication or scaling-up. They may help to increase the catalytic role, but it does not signify that the project has been catalytic. Instead, it means that the project may become larger, but not necessarily yield better results. If the project activities had a catalytic role – such as changing behavior or shifting institutional paradigms, then it should be scaled up and replicated.

In Chinese TVE project, the evaluation team found that the activities of replication, scaling-up, re-catalysis were the main aspects of catalysis, and the catalytic role was assessed apparently within these activities. Regarding the chain of the catalytic process, this evaluation analyzed the logic sequence of the project activities as follows:

First of all, the eight pilot/demonstration projects in four sectors were designed to test the appropriateness of selected technologies. Secondly, if the pilots were proven successful, then the 118 planned-replication projects (or formal replication with the support of GEF funding) would be implemented and these activities might trigger follow-up self-replications. Thirdly, the inside-scaling-up might happen within the project itself and the outside-scaling-up followed. At last, the evaluation found that re-catalytic activities really have happened in some projects with the catalytic effect of the outputs of new techniques, new products, new services and new management mechanisms. Re-catalysis indicates the occurrence of follow-up expansion of

catalytic activities which might likely happen during and/or after the project.

According to the main findings of the final or Terminal Evaluation of this GEF project, the project has clearly fostered a considerable number of independent energy efficiency self-replications. The central PMO estimated about 500 self-replication projects at the end of the project in the four sectors, which have been implemented without direct GEF project funding support. These self-replications were estimated to account for around 30 million tons of lifetime CO_2 savings and an uncounted but clearly large amount of cofunding. There also seemed to have self-replications in Bangladesh, India, Pakistan and USA and other countries – but with also as yet un-quantified results.

For the tracking of the data and evidence of the self-replication activities, this evaluation held an additional stakeholder workshop on June 12 in Beijing, together with the GEF Evaluation Office OPS4 delegation. The Xi'an Wall Material Research and Design Institute in Shaanxi Province provided the latest evidence that nearly 10,000 brick making projects have been replicated nationwide since the completion of the project in 2007. The data was based on the technical renovation contracts signed between the institute and enterprises. Another example of self-replication in the cement industry was provided by Tianjin Cement Research and Design Institute. The statistical data (based on the contracts signed with the institute) showed that there are 158 replication cases nationwide in China and nine projects (with 20 cement production lines in use) were replicated in four countries, namely, Pakistan, Thailand, Philippines and Malaysia.

For the scaling-up activities, the evaluation team visited stakeholders and held stakeholder workshops during the field trips in four provinces. Fifteen of the 20 enterprises/projects (or 75% of them) interviewed have proved the fact that they had really implemented the inside-scaling-up activities, including more investments in the old production lines, introduction of new production lines with the same technology, and/or enlargement of their product sales. For outside-scaling-up activities, there were still limited statistical data available during this case study evaluation. But some evidence could support the findings that the outside-scaling-up activities indeed have happened. The Tianjin Cement Research and Design Institute has replicated 158 projects nationwide in China; nine projects were replicated in four countries; and the Xi'an Wall Material Research and Design Institute in Shaanxi Province has replicated nearly 10,000 brick making projects nationwide since the project was finished in 2007.

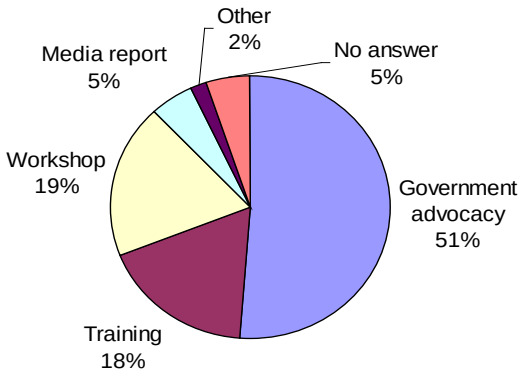
Moreover, the evaluation found that media agencies could play an important role in promoting GEF catalysis. During the implementation of the Chinese TVE project, media campaigns in newspapers, on TV and on the internet have proven to be useful tools for GEF's catalytic role. For example, the video training program on hollow brick technology was played on China Central Television (CCTV) channel-7 for a whole week; the dissemination network of a DVD on brick production technology was established nationwide and the disks were circulated in many provinces in China; the reports on the success of Shenhe Cement Co. Ltd in 'pure low temperature waste heat recovery and power generation' were published or televised several times by China's major press. Moreover, BBC has made a TV program about the Xianyang Zhouling Brick-Making Plant in Shaanxi Province and broadcasted it globally.

Furthermore, using the internet to introduce the TVE project was an easy way to disseminate the information and knowledge of EE technology. Many TVE pilot plants as well as industrial associations had their own websites, helping stakeholders to track the latest progress and development of the TVE project.

5.2 Catalyzing Actor-Central PMO

According to the concept of catalyzing and catalyzed actors, different stakeholders play different roles in the catalytic process. For example, the central government and local government took the main responsibility of inducing catalytic changes and they could be considered as important catalyzing actors. For example, the questionnaire asked where did enterprises get the information about the GEF TVE project, 51% of the entrepreneurs selected the answer 'government advocacy activity' (See Figure 5).

Figure 5 From Where to get the Information about Chinese TVE project?



At the central government level, the central PMO launched eight pilot demonstration activities and initiated 118 planed-replication projects at the beginning of the project. The PMO conducted demonstration activities as planned by project design. These activities were mainly in the form of designing the institutional systems of PICs and LPICs, promoting the establishment of industry associations, and organizing technical trainings and dissemination workshops. According to the statistical data, the central PMO organized 13 nationwide training activities, and more than 1,200 people participated in the events during project implementation. These training activities broadly covered not only the issues of climate change policies and strategies, energy saving awareness and practical technologies, but also topics of Chinese and global economic trends, enterprise management tools, voluntary agreements and so on. Moreover, the PMO invited representatives from local governments and pilot enterprises to attend their annual meetings in Beijing to exchange and share the project implementation experience. The important activities undertaken by the PMO are summarized in Table 5.

Table 5 Important Demonstration Activities Organized by Central PMO

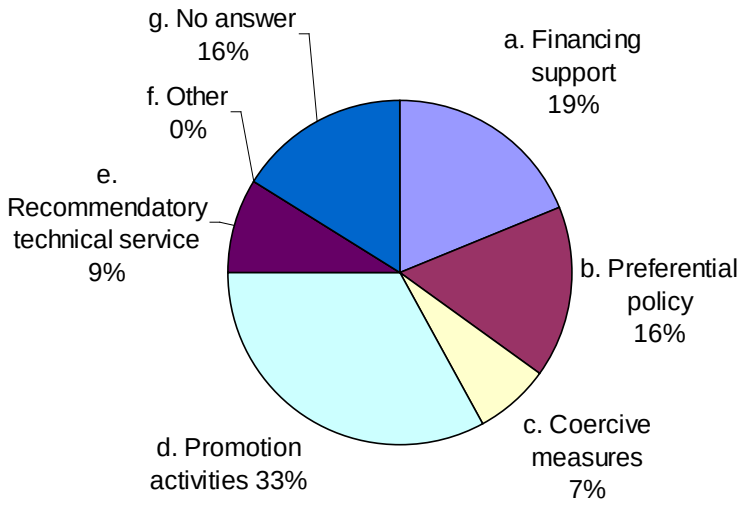
Date	Activity
April 2004	Xi'an brick-making training
April 2004	Beijing casting training
April 2004	Xuzhou cement training
May 2004	Tsinghua University casting training
July 2004	Ningbo casting training
July 2005	Shanxi casting training
July 2005	Tianjin casting training
July 2005	Dalian casting training
September 2005	Hangzhou cement waste heat recovery and power generation training seminar
June 2006	Participated IFAT2006 Shanghai International Energy Saving and Resource Comprehensive Utilization Exhibition
September 2006	On-site meeting and Wall Material Reform Forum in Shenyang
October 2006	On-site meeting and Coking Sustainable Development Forum in Shanxi Gaoping
November 2006	On-site meeting and Casting Sustainable Development Forum in Nanjing

Source: Project Document.

5.3 Catalyzing Actor-Local Governments (LPIC)

Most of the local governments started to be concerned about TVE energy saving after the project's successful demonstrations at the central government level. As eight TVE pilot/demonstration projects provided good examples for promoting energy saving and emission reduction practices, the local governments incorporated the TVE demonstration activities into their daily work by initiating preferential policies, and organizing advocacy meetings and technical trainings. With the efforts of local governments, the replication effects of the TVE project have been expanded greatly with broader coverage of local enterprises. See the following figure, table and box.

Figure 6 Actions by Local Governments to Promote Energy Savings and GHG Reduction



Moreover, the evaluation also found two good examples of the application of local preferential policies which were mandated in Zhejiang Province and Shanxi Province. In 2003, when Zhejiang Shenhe cement plant, as one of the pilot projects, successfully demonstrated the technology renovation of five stage cyclone pre-heater waste heat recovery and power generation, the Zhejiang Province Authority soon initiated a special policy for free electricity grid connection if enterprise would introduce this technique for power generation in cement industry. In Shanxi Province, the local government took the techniques of 'clean type heat recovery coking oven and waste heat power generation,' which were demonstrated by GEF pilot projects, as the preferential EE technique in the coking industry and a number of local policies were made to encourage the replication of these techniques.

Table 6 Local Government's Actions in Supporting GEF Project

Action	Example
Preferential policy	1. Tax deduction and exemption policy 2. Preferential loan policy 3. Technique renovation allowance policy 4. Policy for free grid connection if enterprise implementing waste heat recovery technique for power generation in cement industry and simplified approval processes policy in Zhejiang Province 5. Clean type heat recovery coking oven and waste heat power generation were listed as preferential techniques of coking industry by Shanxi Province
Financial support	1. Special fund for energy saving technical renovation

	2. Reward for resources comprehensive utilization
Organized activities	1. Technical training 2. On-site demonstration 3. Media report
Coordination	1. Coordination with banks on TVE loans 2. Coordination with research institutes, industry associations

Sources: Project Document and site visits.

Box 3 Project Replication Experience of Jinnan District of Tianjin

Jinnan District of Tianjin is famous for its metal casting industry with 162 foundry plants and nearly 250 chemical plants. Energy saving and environment protection had been the top priority of the local government for a long time. The seven TVE project replications were considered as an opportunity to promote GEF's catalytic role. Particularly, the local government of Jinnan District encouraged foundry enterprises to conduct energy saving measures by providing each enterprise 50,000RMB for the technical renovation. In total, the local government allocated 5 million RMB to support this kind of technique renovation every year in the region.

In addition, the government introduced the experience of the TVE project to other industries such as chemical and glass making and similar kilns in these sectors were requested to be renovated. At same time, the local government also organized a number of technical trainings and invited experts to help enterprises to advance technology. Experience drawn from a Tianjin TVE replication project showed that the local government itself has benefited from the project catalyzing progress.

Source: Stakeholder Workshop.

5.4 Catalyzing Actor-Associations

During the catalysis process, industry associations proved to be important actors for catalyzes and their demonstration activities were based on the networking and partnerships in the form of knowledge sharing and technology transfer. The effective demonstration activities organized by associations in the cement, brick, coking and casting sectors were highly welcomed and appreciated by local replication enterprises. More and more enterprises, research institute and suppliers joined the network. Then, the demonstration activities of the GEF project have been enlarged in a catalytic way.

Box 4 Association played as important catalyzing actor in TVE project

The Xi'an Wall Material Industry Association in Shaanxi Province was set up in April 2004 relying on Xi'an Wall Material Research and Design brick enterprises and related institutes. The association is an alliance of brick enterprises, related institutes and suppliers; it has played a significant role in providing technical consultancies and feasibility studies, as well as organizing trainings for TVE replicated projects in the local area. Annual association meetings were held to discuss issues related to energy consumption saving, GHG emission reduction and the sharing of best practices of TVE replication projects.

During the evaluation, the Association members reflected that this platform was really helpful for accessing the latest industrial information, new technology, known research institutes, as well as skillful experts. Also, the platform enabled members to learn from each other and share the practical technologies amongst themselves. Moreover, the association organized some local brick enterprises to pay technical visits every year around China to learn and exchange experiences with other GEF brick replication projects.

Source: Stakeholder Workshop.

Closely linked to the industry association of GEF projects, Xi'an Wall Material Research and Design Institute in Shaanxi Province has provided the evaluation team with the latest evidence, showing that nearly 10,000 brick making projects have been replicated since the completion of the project in 2007. The data was based on technical renovation contracts signed between the institute and the self-replication enterprises.

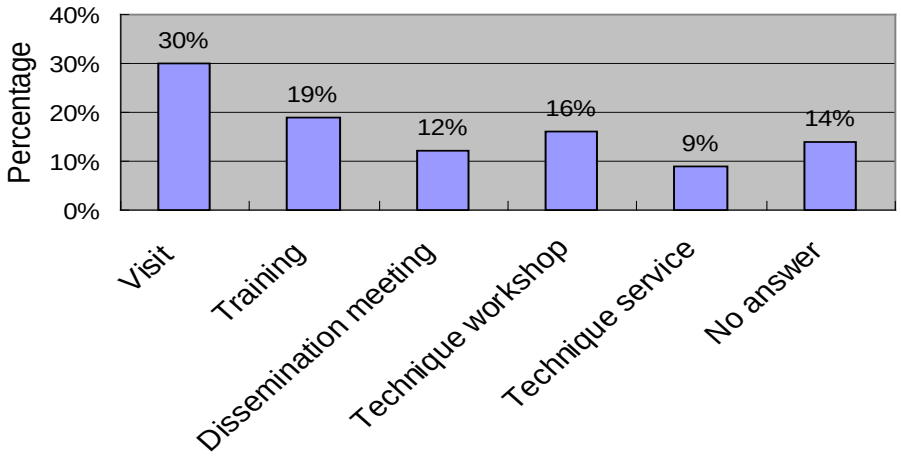
5.5 Catalyzed Actor-Project Enterprises

TVE enterprises are the target group of catalysis. Through the pilot, demonstration and replication activities, these enterprises improved their environmental protection awareness and changed their behavior, so they are classified as catalyzed actors. Before the project started, energy saving and GHG reduction were rarely a concern in Chinese TVE enterprises, especially in the selected four sectors. Energy efficiency and GHG emission reduction were new concepts for these small-size plants and few entrepreneurs wanted to invest in technical renovations for energy saving. After the pilot/demonstration activities had been successfully organized by the central PMO and local governments, the entrepreneurs realized the replication of EE technology was not only profitable to them but also in favor of GHG reduction. Since then, hundreds of TVE investors changed their strategy and pursued long-term technology renovation and innovation to save more energy.

It was very interesting to note from the questionnaires that on-site visits to replication projects, training and technique workshops were the most important approaches that

might induce follow-up catalytic activities. Of the entrepreneurs polled 30% thought a visit was the most effective activity during the catalyzing process (See Figure 7).

Figure 7 What is the Most Effective Approach to Catalytic Activities?

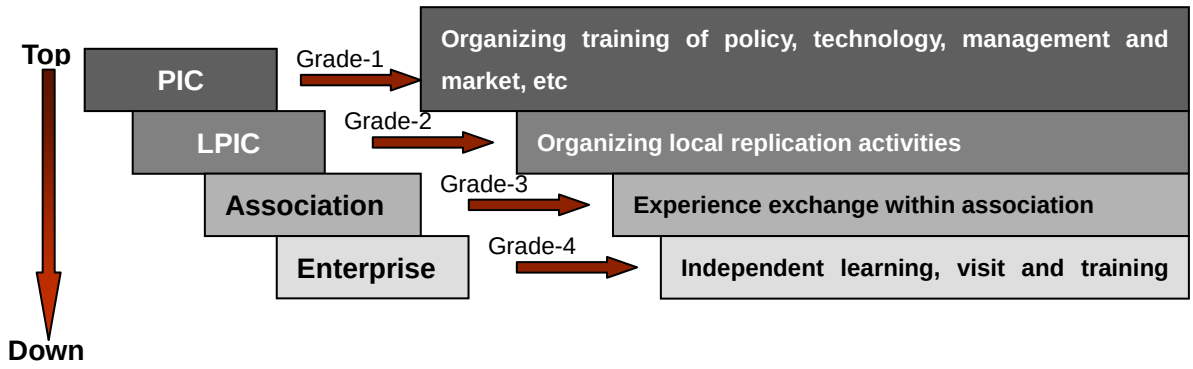


The evaluation found out that not only domestic entrepreneurs but also foreign delegates from US, German, Japan, India, Iran and Bangladesh have visited the pilot/demonstration projects to learn or share the experience of the GEF project. After the visits, self-replication was extended to other regions around China or even to other countries. Take Xi'an Liucun Hollow Brick Plant in Shaanxi Province as an example. As a GEF brick making pilot/demonstration enterprise, it has received more than 100 visits of domestic enterprises and the visits of some 15 foreign companies. Moreover, the plant has received and trained five Bangladeshi workers for free and replicated its project design and techniques to a Bangladeshi company.

5.6 Four-Grade Catalytic Activities

In this project the main actors and their activities can be classified into four categories or four grades (See Figure 8). Although at the design stage of the TVE project, the catalytic conception was implicit, the evaluation found that the catalytic effect really existed at the end of and after the project, through the implementation of demonstration and replication activities at different levels in different regions. Also, the central government (represented by the PMO or the PIC), local governments (usually represented by LPICs), enterprises and associations worked together and effectively played their different roles in promoting GEF project catalysis which had induced dramatic changes in individuals and institutions.

Figure 8 Four-Grade Catalytic Activities in Chinese TVE Project



As Figure 8 shows, the four-grade catalytic activities can be considered as a 'top-down' model because the nature of the TVE project design is 'planed activities oriented.' For example, for overcoming the barriers of the GEF project, the central and local governments took the responsibility of inducing catalytic changes and designed a proper implementation mechanism to guide the activities of associations and the project enterprises. Based on the project design, the catalytic strategy or planning undertaken by different levels of governments were the implementation of eight pilot/demonstration projects in four sectors and achieving the objective of the 118 replication projects in different regions of China. All these pilot and replication projects have received the GEF support funding. On the other hand, some self-replication enterprises did not get the financial support from the government or from the GEF grant, but they have independently implemented a series of replication activities which were developed in the direction of self-perpetuating with results far beyond the previous GEF TVE project design.

6. Key Findings and Recommendations

6.1 Key Catalytic Factors in the Case Study

In chemistry, catalysis is defined as the acceleration or slowing down of a reaction by means of a substance, called a catalyst, which is itself not consumed by the overall reaction. The word 'catalyst' has moved beyond science into more general usage in socio-political and private sector fields, for example, a 'catalyst for political change,' and 'catalyst for market change.' The key notion is that a small substance or agent such as financing or technical assistance can cause larger changes, such as change in political direction or policy or change in markets for a product.

In this case study, the evaluation found four key catalytic factors, or 'catalysts,' that have played dominating roles in accelerating the process of catalytic activities and

promoting the effects of catalysis. These key factors include the selection of appropriate technology, governmental driving force, market demand and financial leverage.

(1) Selection of Appropriate Technology. For the TVE project, the first barrier that needed to be removed was the barrier to technology and the project clearly has advanced the application of energy efficiency technologies in all four TVE sectors (brick, cement, metal casting and coking). While what is important is that, as the evaluation found, the selection of appropriate technology can affect to which extent the project realizes its catalytic goal. If proper and practical technology was selected, it would be easier to foster replication activities and trigger self-replications. In selecting these renovation techniques for four sectors, the PMO, research institutes and pilot enterprises worked closely to determine what kind of proper technology should be used.

There are several reasons to highlight the importance of the appropriateness of technology. Firstly, for climate change projects, usually a specific technique should be tested through a pilot project then demonstrated and replicated when it has been proven successful. Secondly, the selected technology should be tailor-made to suit China's situation. The evaluation found that only the appropriate and applicable technology could attract entrepreneurs and then rapidly be adopted at the regional or even at the national level. Thirdly, from the technical side, the technologies applied in the four sectors differ from each other. The technical renovations in the cement and coking sectors usually needed larger investment and the applied technologies were complex and unique; while in the brick and foundry sectors the technical renovations were rather easily done with smaller investment. Fourthly, the right selection of cost-effective technology can help to enlarge the catalytic effect, because the TVE enterprises welcomed the technology and equipment with high performance and relatively low investment.

(2) Strong Support from Government. In the case study, it is found that favorable policy environment and powerful coordination of the project implementation with the governmental have contributed to the achievement of the intended or unintended catalytic role of the GEF. Therefore, the role of the government can be considered as a 'driving force' for catalysis. The evaluation found two good examples of the application of local preferential policies which were mandated in Zhejiang Province and Shanxi Province. In 2003, when Zhejiang Shenhe cement plant, as one of the pilot projects, successfully demonstrated the technology renovation of five stage cyclone pre-heater waste heat recovery and power generation, the Zhejiang Province Authority soon initiated a special policy for free electricity grid connection if enterprise would introduce this technique for power generation in cement industry. In Shanxi Province, the local government took the techniques of 'clean type heat recovery coking oven and waste heat power generation,' which were demonstrated by GEF pilot projects, as the

preferential EE technique in coking industry and a number of local policies were made to encourage the replication of these techniques.

The role of the government in supporting GEF projects are concluded in the following aspects. First of all, energy saving and GHG reduction have drawn the growing attention of Chinese government in the past decade, which have been put as priorities of development policy of the government at all levels. For example, in 2004 the central government issued the national *Eleventh Five-Year Development Plan* (for the period 2006-2010), with its strong emphasis on the objective of "energy consumption per unit of GDP to be reduced by 20% in five years." If the governmental laws, regulatory frameworks, and policies were not in place to support the TVE project, the GEF catalytic effect would have achieved at lower scale. Secondly, in the TVE project, the main actors and their activities can be classified into four categories or level grades with the nature of a 'top-down' institutional structure, i.e. from the central government (represented by the PMO or the PIC), local governments (represented by LPICs), industrial associations, to enterprises. The national and local Policy Implementation Committees (PIC and LPIC) have provided strong and effective project leadership and co-ordination and a number of effective promotion activities were organized. Furthermore, the project has made good use of PMO and PIC links to assist the development of policies to prohibit some outdated and energy inefficient technologies.

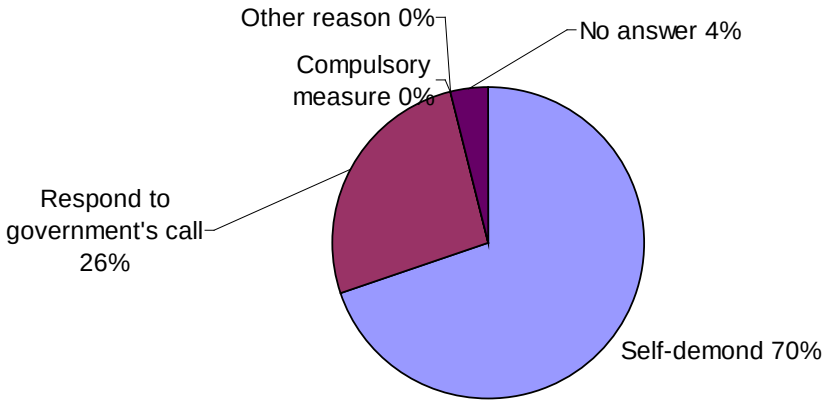
(3) Market Demand. Through the analysis of the case study, another important catalyst of the TVE project can be defined as 'market demand.' The sectors of brick, cement, coking and metal-casting are high energy consuming industry in China and the enterprises in these sectors are big consumers of coal and electricity. In China, coal is the main source of energy. As China's economy has been developing rapidly in recent years, the price of coal has increased very fast. During the TVE project cycle (2001-2007), the price of coal increased from 200 RMB per ton to 600 RMB per ton on average. The higher price of coal resulted in higher production cost and lower profit for the TVEs. Thus, TVE entrepreneurs themselves had a very strong willingness to reduce energy consumption and were very keen to install energy efficient technologies.

Another factor was the shortage of electric power supply in some provinces which has influenced the regular operations of TVEs in the cement sector. For example, in Zhejiang Province, where the GEF pilot enterprise Zhejiang Shenhe Cement Co. Ltd is located, some regions had the problem of shortage of power supply. In order to guarantee the electric supply for civilian use, cement plants were often ordered by local governments to stop operation or to run operations part time, with the most serious case of only running three days a week. This problem, on the other hand, has greatly urged many local cement plants to actively participate in energy efficiency technical renovations, soon after Zhejiang Shenhe Cement Co. Ltd successfully demonstrated the technique of five stage cyclone pre-heater waste heat recovery and power generation. The

application of this EE technology was a very good example of a win-win solution, because not only were the objectives of energy saving and GHG reduction achieved, but also these enterprises gained large profits from the use of waste heat recovery and power generation.

The case study questionnaire found that 70% of the surveyed entrepreneurs thought that the reason for their implementation of energy efficiency technical renovations was primarily based on their 'self-demand,' which can be regarded as a 'market demand driving factor.'

Figure 9 Why Entrepreneurs Want to Implement EE Technical Renovation?

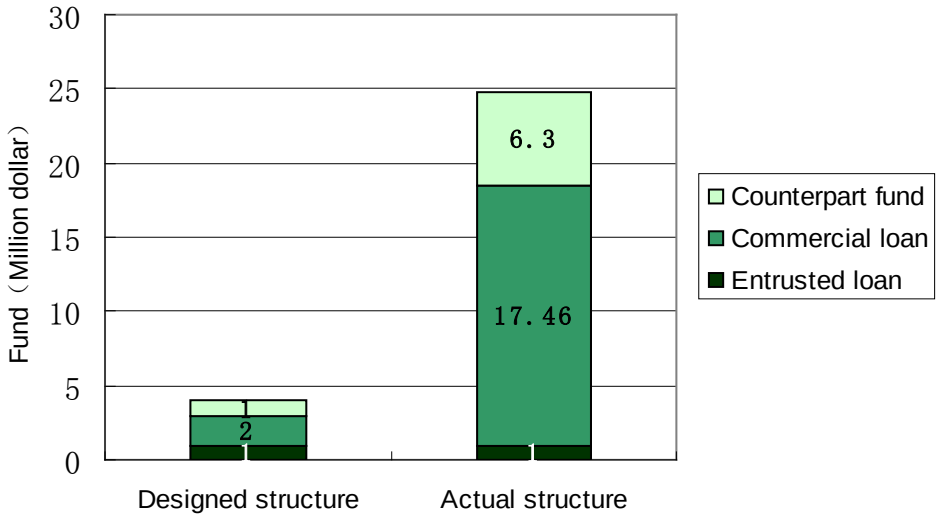


(4) Flexibility of Funding. In seeking to maximize global environmental benefits, the GEF emphasize its leverage of additional financial support from other sources, which is a prominent factor of catalysis. In the TVE project, the Rolling Capital Funding (RCF mechanism) was designed for removal of financial barriers originally, which encompassed three parts, namely, (1) $1 million entrust grant managed by Hongyuan Company (MOA); (2) $2 million loan provided by the Agriculture Bank of China (ABC); (3) $1 million for capacity building from MOA.

The design of RCF with an amount of $4 million was implemented very effectively with an actual result of leveraging $24.76 million of cofunding from the ABC, other banks in China, as well as from the formal replication and self-replication enterprises. Statistic showed that the loan from ABC alone was summed up to $17.46 million for eight pilot projects, which far exceeded the original plan of $2 million. The reason why ABC would provide more loans to projects supported by the GEF lies in the fact that the enterprises could make big profit from the energy efficiency technology renovations and the money could be safe for the bank. At the same time, ABC also gained profits from the lending.

Thus, this RCF mechanism triggered large amounts of investment, smoothly removing financial barriers. Other banks in China have been increasingly interested in providing commercial loans to TVEs as they seek new business opportunities in a competitive banking marketplace. Figure 10 below shows the actual components of the RCF mechanism.

Figure 10 RCF Structure for Eight Pilot Projects



Source: PMO Self Evaluation Document.

The evaluation found that the GEF financing accounted for only 0.4-20% of renovation funding in the eight pilot projects that were implemented. This fact demonstrates the significant leveraging role of GEF funding. Furthermore, the evaluation found that the large number of independent self-replications was not specifically articulated in the design of the project or was funded by the GEF.

6.2 Verification of the GEF Catalytic Role Strategies

During the evaluation of the Chinese TVE project, the evaluation team found that most of the contents of the GEF catalytic role strategies shown in Table 7 below closely responded to the nature of the project activities. Therefore, the table can be used as a useful tool to analyze the catalytic strategies of GEF project in the future.

Moreover, based on the evidence and opinions collected, the evaluation team checked the applicability of each strategy and gave a rating. For some of the strategies, the Chinese TVE project was found to ‘very strong evidence,’ while one strategy was assessed as ‘absent’ and the other one as ‘weak evidence’ respectively.

Table 7 - GEF Catalytic Role Strategies and Applicability Checked by the Evaluation

Strategies	How (Sub-Strategies)	Checked by the Evaluation
Awareness	• Increase knowledge about the issue • Dissemination of project results	• Strong evidence • Strong evidence
Individual Capacity Building	• Technical skills • Resource management	• Strong evidence • Moderate evidence
Institutional Capacity Building	• Standards • Partnerships and Networks • Legislation and policies • Strategic plan • Financial • Developed database • Created institution • Framework • Infrastructure • Equipment • Research projects • Monitoring & Enforcement	• Strong evidence • Very strong evidence • Moderate evidence • Strong evidence • Very strong evidence • Absent • Strong evidence • Moderate evidence • Strong evidence • Very strong evidence • Very strong evidence • Moderate evidence
Create Markets	• For new technologies • Incentives	• Very strong evidence • Very strong evidence
Demonstration	• Provide a model • Show demand and use for product	• Very strong evidence • Strong evidence
Modernize systems	• Upgrades • Replacement • Remediation	• Moderate evidence • Moderate evidence • Strong evidence
Pilot	• Model new concept or product	• Very strong evidence
Protected Area	• Create • Expand	• Not applicable • Not applicable
Replication	• Technique/program used by another place	• Very strong evidence
Scaling-up	• Expansion of project • Incorporated into national government or agency	• Strong evidence • Very strong evidence
Sustainable Economic Activity	• Alternative livelihoods for local communities • Diversify local production systems • Ecotourism	• Strong evidence • Very strong evidence • Weak evidence

6.3 Recommendations

(1) Improving the GEF Conceptual Framework of Climate Change Project. The original conceptual framework provided by the GEF Evaluation Office for

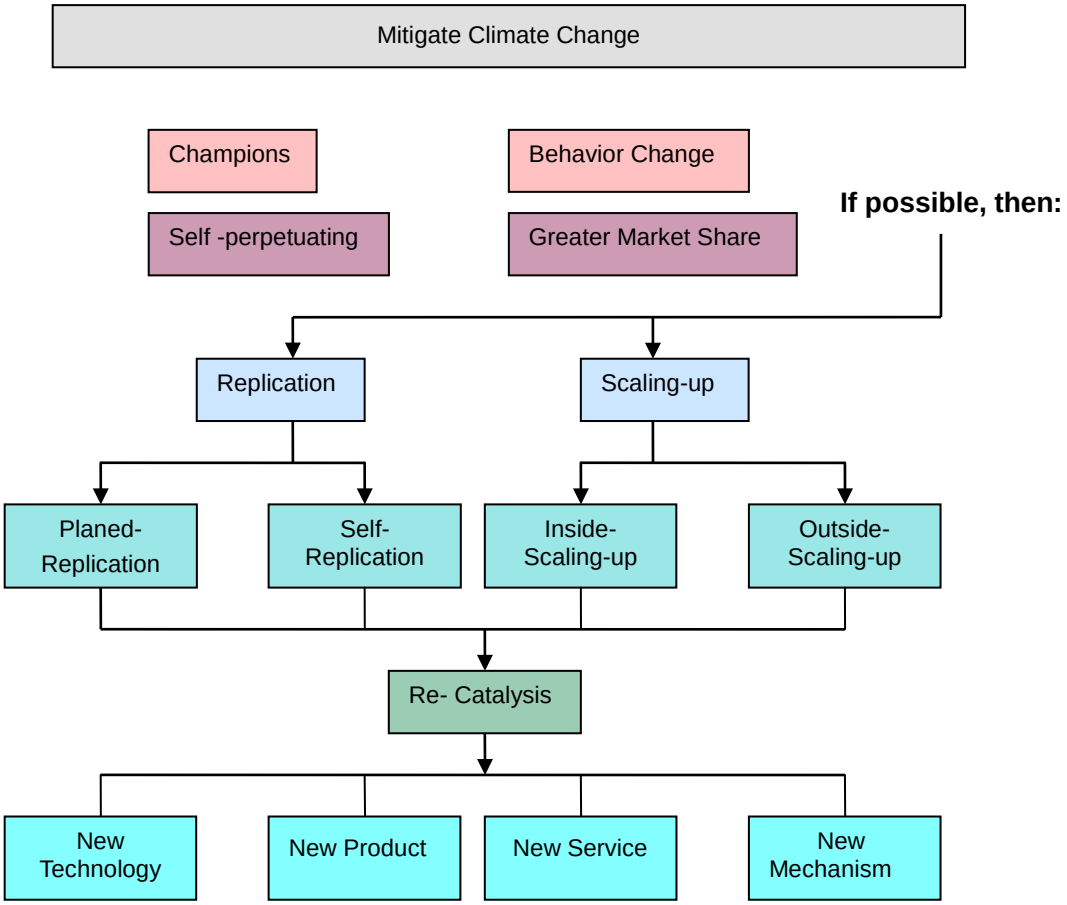
climate change project was basically approved of through this case study and found to be correct and applicable but still the conceptual framework will need to be further verified and elaborated in the OPS4 review in China and other countries.

According to the GEF conceptual framework (See Section 3.1, Figure 2 Conceptual Framework of Climate Change Project), the evaluation team found that most of the contents of the framework were incorporated with the catalytic activities of the Chinese TVE project. In general, catalysis concerns change and is closely related to the concepts of demonstration, replication and scaling-up. If the project activities had a catalytic role – such as changing behaviors or shifting institutional paradigms, then it should be scaled up and replicated.

In the Chinese TVE project, pilot/demonstration, replication and scaling-up were found to be the main elements of catalysis, and the catalytic role was apparent with the emergence of champions, behavior change, greater market share and self perpetuating. Furthermore, the re-catalysis phenomena were also found by the evaluation team in the Chinese TVE project, with the outputs of new technology, a new product, a new service and a new management mechanism.

Therefore, the evaluation suggests that the additional elements as illustrated in Figure 11 may be added to the GEF original Conceptual Framework of Climate Change Project.

Figure 11- The Supplement of GEF Conceptual Framework of Climate Change Project



Note of the Key Wordings:

A- Replication describes the occurrence of a similar type of project (and usually of a similar size or scale) but in another location.

B- Scaling-up implies expanding the scale of the original project (inside or outside the project), such as taking it from a local to regional scale, or having a national government incorporate the project into a national program or agency.

C- Re-Catalysis indicates the occurrence of follow-up expansion of catalytic activities which might likely happen during and/or after the project. The outputs of re-catalysis may include new technology, a new product, a new service and a new management mechanism.

(2) The Study Approach to GEF Catalytic Role Evaluation in the Future. The evaluation team suggests, based on the lesson learned and shared experience, that the future case study approach to GEF catalytic role should firstly focus on

the analysis of the catalytic process with reference to the conceptual framework. Secondly, the policy environment and foundation (such as awareness and capacity building) should be assessed. Thirdly, the evidence of catalytic activities should be collected comprehensively. Fourthly, the catalytic result and impact of the GEF project should be analyzed, including attributions of achievements. Furthermore, the evaluation should identify key catalytic factors and make a conclusion of their contribution to the catalytic role.

The Tracking of Self-replication Activity in the Future. According to the main findings of the Terminal Evaluation, the project has clearly fostered a considerable number of independent energy efficiency self-replications (about 500 cases estimated by the PMO at the time of the final evaluation) that have been implemented without direct GEF project funding support. These self-replications were estimated to account for around 30 million tons of lifetime CO_2 savings and an uncounted but clearly large amount of cofunding. There also seemed to have self-replications in Bangladesh, India, Pakistan and USA and other countries – but with also as yet un-quantified results.

For the tracking of the data and evidence of the self-replication activities, the evaluation team held an additional stakeholder workshop together with the GEF Evaluation Office OPS4 delegation. The Xi'an Wall Material Research and Design Institute in Shaanxi Province provided the latest evidence that nearly 10,000 brick making projects have been replicated nationwide since the completion of the project in 2007. The data was based on the technical renovation contracts signed between the institute and enterprises. Another example of self-replication in the cement industry was provided by Tianjin Cement Research and Design Institute. The statistical data (based on the contracts signed with the institute) showed that there are 158 replication cases nationwide in China and nine projects (with 20 cement production lines in use) were replicated in four countries, namely, Pakistan, Thailand, Philippines and Malaysia.

Based on the above findings, the evaluation suggests that the tracking of the effect and impact of self-replication activities is very important for GEF. It will be useful to incorporate tracking of self-replication in the whole process of project design, implementation and conclusion. For follow-up of GEF climate change projects, and if the PMO still exists, the tracking of self-replication should be further emphasized and promoted.

Annex A. Terms of Reference

Terms of Reference for the China Case study of the Evaluation of the GEF catalytic Role

Background/General Description of the GEF

1. The Global Environmental Facility (GEF) is a financial mechanism that provides grant and confessional funding to projects and activities to protect the global environment in developing countries and countries in economies in transition. The GEF Secretariat services the GEF Assembly and the GEF Council in cooperation with global environmental conventions dealing with the focal areas of climate change, biodiversity, international waters, land degradation and persistent organic pollutants. Project financed by the GEF are mainly managed by its three Implementing Agencies - United Nations development Program (UNDP), United Nations Environment Program (UNEP), and the World Bank. The GEF Secretariat and the independent GEF Evaluation Office (GEF EO) are located in and are administratively supported by the World Bank.

2. In June 2006, the GEF Council approved an evaluation of the GEF catalytic role. The catalytic role of the GEF is reflected in the GEF Operational Strategy (OS, 1994) as one of ten Operational Principles for the development and implementation of the GEF Work Program. Specifically, the Operational Principle 9 states: “In seeking to maximize global environmental benefits, the GEF will emphasize its catalytic role and leverage additional financing from other sources.”

3. There is no agreed definition of catalytic effects. It implies that, given the limited amount of money available for projects, the GEF hopes to design projects in such a way as to attract additional resources, pursue strategies that have a greater result than the project itself, and/or accelerate a process of development or change.

4. The GEF is conducting an evaluation to better understand the relationship between its catalytic role and the attainment of global environmental benefits. The objective is to explore how the GEF conceptualizes and implements its catalytic role to maximize global environmental benefits. The overall evaluation addresses the following questions:

a. How does the GEF conceptualize its catalytic role?
b. How can the catalytic role be measured?
c. How does the GEF operationalize its catalytic role?
d. What is the effect of different strategies used for promoting catalytic effects?
e. To what extent is the GEF catalytic?

5. Several evaluations conducted by the GEF Evaluation Office have pointed to difficulties in implementing and assessing the principle of catalytic role. Phase 1 of the evaluation has therefore focused on methodology to develop a conceptual framework for the catalytic role in the GEF focal areas. Phase 2 will consist of field work case studies to test the framework and gather findings and lessons learned on application of the GEF catalytic role and emerging effects.

Selection of case studies

6. **Objective**. The case studies aim to (a) Help test and validate the conceptual frameworks for catalytic role; (b) gather findings and lessons learned on application of the GEF catalytic role and emerging effects at country level. The case study report will feed into the overall evaluation report.

7. **Criteria.** Selection will be targeted, based on preliminary scoping by GEF EO among closed and on-going projects. To ensure a representative coverage, preliminary overall criteria include:

a. Representation of all three **focal areas** (biodiversity, climate change, international waters).

b. Representation of **regions**, as broad as possible (given the evaluation budget, visits to tentatively 3-5 counties are likely). Priority coverage: Africa, Latin-America, Asia; East Europe and Arab States also considered.

c. Presumed **successful**; focus on positive experiences with catalytic role.

d. Relevance to future programming (case should fall within the **GEF-4 priorities**).

e. **Catalytic nature** of the project: Coverage of all the main catalytic strategies

- Strategy 1 - Market Demonstration / Transformation (mainly climate change)
- Strategy 2 - Changing Local Practices (mainly BD)
- Strategy 3 - Policy advocacy and Bureaucratic Change/Partnering (mainly IW)

f. Illustration of **other catalytic approaches** (replication, policy, capacity building, innovation, pilot and demonstration, scaling-up, sustainability, co-financing, champions, context and impact drivers.).

g. **Project age** (should be closed or nearing closure).

h. **Availability of data** (project should ideally have an evaluation report or other good documentation).

i. **New area** not studied in detail before, needing field work (avoid if much technical information already exists within GEF on subject).

j. Presence of **clusters** of projects with high potential for intended catalytic effect in the focal area; and/or more than one project with presumed catalytic effects in the country.

k. **Practical** considerations; coordination with related evaluations and initiatives for field visits, such as possible parallel field visits with Agency partners conducting evaluations on related subjects.

7. China presents a good opportunity for field work for the evaluation. An exploratory mission by the EO to China in September 2007 found that a possible case study was welcomed by the Chinese authorities, and identified several possible options for case study (within industrial energy efficiency; renewable energy; and natural reserves). In addition, China presents useful lessons learned on other completed projects (such as the fridge/light bulb projects) that can be used for

related desk reviews for the overall catalytic role evaluation. In particular, China presents an interesting case, because of its large potential and scale for catalytic effects and scaling-up; the broad range of the portfolio with a considerable number of closed projects; several projects with explicit objectives of scaling-up and replication; and the government policies and commitment to demonstration pilots and replication. Also of high importance in China are the notions of seed money; links to central policy change; and national ownership.

8. The China *Energy conservation and GHG emissions in Chinese Township and Village Enterprises (TVEs)* (GEF ID 263+622, agency UNDP) is proposed as a case study because of the linkages the project design (and evaluations) make between replication and the attainment of global environmental benefits. The project has potential to yield findings and lessons, which could inform the future development of GEF interventions in the focal area. It falls within the GEF-4 priorities of Energy Efficiency in Industry (OP5) in climate change. It closed in 2007, with a terminal evaluation in July 2007, and can therefore provide up-to-date information. The project strategies cover all the strategies identified in the preliminary conceptual framework including information on replication, demonstration, capacity building, policy, funding, and markets. There is also the possibility to consider lessons learned from related industrial energy efficiency projects in a desk review (evaluations available, WB 97 *Energy Efficient Industrial boilers;* WB 98 *Energy conservation I&II*).

Tasks

9. As per the overall Approach Paper (see separate paper), the consultant(s) will conduct desk research and reviews for the evaluation. The consultant(s) will work under the supervision of the EO Task Manager of the evaluation and the Evaluation Officer(s) or other consultants working on the evaluation. He/she will liaise as necessary with the GEF EO colleagues, government, Implementing/Executing Agency country offices, projects and other relevant entities. The consultant(s) will undertake a case study related to the evaluation of the GEF catalytic role, with specific tasks to:

a. Inform themselves of the GEF mandate, methodology information on the catalytic role (provided by EO) and the select project(s); obtain and review **documentation** on the project (including project documents, mid-term reviews and monitoring reports, terminal evaluations etc.) to results, strategies and status at project end. Fully use and summarize the terminal evaluation with regard to activities and outputs and results.

b. Use the draft catalytic **framework** (for the relevant focal area, provided by EO, see annex) for analysis of the case study, test its application, and develop suggestions for its improvement.

c. Identify relevant stakeholders and conduct **interviews** to identify effects of the project(s); strategies applied; the story behind the project and any changes in the situation targeted by the project. This may include government offices, local government, GEF and Agency staff, project management, beneficiaries, private sector companies, associations, evaluators and academia.

d. Analyze and describe the **context** of the project at its start, evolution during the project, at project end and after. This would include relevant economic, political (policy changes), environmental, and social trends, to identify:

- key changes in the development situation and the extent to which these can be considered catalytic[1]; and
- contextual factors that influenced the project results (i.e. hindered or promoted catalytic effects).

e. Based on the above, analyze the **role** played by the GEF project in the context of the activities of other actors in the sector, and the extent to which this role was catalytic. The catalytic role played can be considered at several levels: At country level; sub-national (or provincial) level; project site level; sectoral level; and/or individual level. The study will focus on replication and implications of the project beyond its immediate outputs.

f. Based on the above, summarize **factors** or **lessons learned** that contributed to (or are linked to) the catalytic role of the project, either external (see above) or internal to the project. The internal analysis would include discussion of which strategies were especially effective in catalytic effects, and why; timescale involved; and (if found) links to sustainability; policies; replication, capacity building; demonstration or pilots; cofinancing and/or individual champions.

g. **Summarize lessons** learned from related GEF project in the focal area in the country (evaluations of WB 97 *Energy Efficient Industrial boilers;* WB 98 *Energy conservation I&II*).

h. Develop and/or use appropriate **tools** to present the analysis, such as databases qualitative data analysis software and search engines. If useful, the consultant(s) could develop a timeline of events and actions to map results and project contribution; and/or a results chain model. The consultant(s) may, for example, choose to focus in-depth on 2 sectors (of eight pilot projects, 118 replication TVEs) targeted by the project, after discussion with EO.

i. **Write** a paper with findings from the above field work review, as input to the overall catalytic role evaluation.

j. Conduct any other research or logistical task for the study, as needed and as agreed with the EO.

Roles and Responsibilities

10. The GEF EO Task Manager is responsible for:

- Overall responsibility and accountability for the case study
- Coordination within the Evaluation Team and with the Local Consultants

[1] The study can consider both intended and unintended catalytic effects of GEF activities, where available.

- Guidance throughout all phases of execution
- Approval of all deliverables
- Co-ordination with other pilot case studies

11. The Local Consultant(s) are responsible for:

- Conducting the case study fieldwork
- Day-to-day management of operations in the field
- Regular progress reporting to GEF EO Task Manager
- Development of findings and lessons
- Production of deliverables within contractual requirements

12. The Chinese government organizations, as represented by the Department of International Cooperation of Ministry of Finance (MOF), the GEF China Office and the Implementing Agencies concerned, will be requested by the EO to provide necessary support to the local consultant(s) in facilitating access of information and to stakeholders, and arranging meetings. They will also be asked to provide comments and observations to the draft report.

13. The case study will be carried out in conformity with the principles, standards and practices set out by GEF EO (including the Code of Ethics). Upon clearance of the draft report, the GEF EO remains accountable for documents commissioned and issued under its name, in accordance with the EO Publication Guidelines.

Timeframe and Case Study Process

14. It is expected that the Local Consultant(s) will start the work at the end of May 2008 and take up to 80 working days to complete this assignment. This includes time for drafting the report, and finalizing the document following comments received locally and from the GEF EO. The case study process is split into three phases:

a. Preparatory Phase: The EO Task Manager will brief the Local Consultant(s) on case study; discuss and clarify terms. The Local Consultant(s) will:

- Inform themselves of GEF mandate, review documentation
- Conduct preliminary national-level stakeholder interviews (GEF China Office, Chinese MOF, terminal evaluation consultants, Agency (PMO) and project management staff, select beneficiary companies)

Based on the above, the Local Consultant(s) will develop a case study Work Plan for EO review to:

a. Develop and direct the appropriate methods, data collection, questionnaire, analysis and reporting during the main fieldwork phase.

b. Describe how the case study will be carried out, bringing refinements and specificity to the terms of reference.

The activities in the preparatory phase should further establish the main issues of relevance to the study, enable selection of specific field sites, application of appropriate data collection methods and therefore, allow the Study Team to develop, and finalize a case study work plan. Time allocation will be flexible and will take account of the range of issues to be studied and of logistics.

b. Main Fieldwork phase: The local consultant(s) will conduct fieldwork on 2 sectors (cement and brick) in 4 provinces (Shaanxi, Sichuan, Zhejiang and Guangdong) at the case study site(s), and write a draft report as described in the work plan**.** Propose a draft report outline to EO. The report will be submitted to the Task Manager for preliminary comments.

There are some reasons for the selection of cement and brick sectors as case study sites. Firstly, the number of TVEs in those two sectors (80 projects) accounting for nearly two thirds of the total replication TVEs in China (118 projects), which might present higher representativeness. Secondly, according to pre-desk study of the final evaluation report, a lot of projects in these two sectors have successfully achieved their catalytic effects in different ways. Thirdly, a great number of TVEs that relate to cement and brick sectors are located in the above four provinces, where additional successful replication cases could be likely found. Therefore, it is more possible to find successful cases related to the replication modes addressed in the evaluation design.

c. Stakeholder consultation and Final Report: The Local Consultant and Task Manager will circulate the case study results or main findings (in Chinese) to national and local stakeholders for comment. Following any comments on factual issues accepted, in consultation with the Task Manager, the final report will be submitted

Deliverables and Outputs

15. The Local Consultant will prepare:

- Case Study Work Plan (to be completed by end of preparatory phase)
- Draft report outline
- Case Study Report

16. The report may be published electronically by the EO as a stand-alone document. All reports will be in accordance with the EO Publication Guidelines.

17. These deliverables are to be:

- Prepared in English, except for the final evaluation abstract/executive summary that will be submitted in both English and Chinese for the benefit of local stakeholders.
- The consultant(s) may write in Chinese and have the text translated to English.
- Submitted to GEF EO electronically via e-mail and/or on diskette in MS Word; and in hard copy format direct to the Task Manager.

18. The first draft of the report will be electronically submitted to the Task Manager on or before September 12, Friday, 2008. The Task Manager will provide initial comments within 5 working days. Country Stakeholders will be given 5 working days to provide written comments

on the key findings.

19. The Local Consultant will electronically submit the Final Report (including an abstract/executive summary in English) within two weeks after the deadline for receipt of final comments from stakeholders. An abstract/executive summary in Chinese will be prepared within ten working days of submission of the English version.

Local Consultant Qualifications

20. The Local Consultant(s) are expected to have a background (university degree or above) in economics, science, environmental or related field, with general knowledge of development or environment issues and project management. Demonstrated experience in evaluation. He/she must be systematic and able to distill information to analyze and synthesize documentation to deliver quality analysis under short deadlines. Good English analytical and presentation skills. Mastery of Information Technology. Experience with monitoring and evaluation by donor agencies.

Annex B. Case Study Mission Report

Timetable	Activities	Locations	Participants	People Met/ Agencies Visited
May-June 2008	Kick off meeting Review project documents Evaluation design Identify stakeholders	NCSTE	Chen Zhaoying, Han Jun, Tao Rui, Yang Yun, Shi Xaoyong, Zhang Zixin.	The related governmental officials, experts from GEF China Office, PMO,MOF
July 2008	Interview China GEF office	China GEF office	Han Jun, Tao Rui, Zhang Zhixin	Zhu Liucai, Chen Lan
	Meeting with Project Management Office	PMO	Han Jun, Tao Rui, Shi Xiaoyong, Zhang Zhixin.	Wang Xiwu, Wang Guiling, Song Dongfeng, Tian Yishui, Gao shuang, Chen Lan,
	Zhejiang cement sector field visit and local workshop	Tong xiang and Hangzhou	Han Jun, Tao Rui, Yang Yun, Zhang Zixin	Staff from Zhejiang Shenhe Cement Co.Ltd; TVE/SEM Bureau of Zhejiang Province; Economic and trade Bureau of Tong Xiang city; Economic and trade committee of Zhejiang province
Aug. 2008	Shaanxi brick making sector field visit and local workshop	Xi an, Xian yang	Han Jun, Tao Rui, Shi Xiaoyong	Staff from Liu cun hollow brick plant, Xian yang Zhouling hollow brick plant and other 7 replication enterprises, Economic and trade bureau of Baqiao district, Xian R&D Institute of wall &roof materials, Xian yang wall material association, Xi an wall material association, Government of Baqiao district, S&T bureau of Baqiao district, Environment protect bureau of Baqiao District
	Questionnaire distribution	NCSTE	Tao Rui, Zhang Zhixing	--
	Field visit review and summarizing	NCSTE	Tao Rui	--

Sept.2008	Interview with RCF designer	Beijing	Han Jun, Tao Rui, Shi Xiaoyong, Zhang Zhixin.	Designer from Renmin University of China.
	Interview representative from Tianjin Cement design and research institute			Staff from Tianjin cement design and research institute.
	Interview with representatives from Tianjin replication region			Staff from Tianjin South Area Industry Economy Committee.
	Chengdu field visit and local workshop	Chengdu, Xinjin	Han Jun, Tao Rui, Zhang Zhixin.	Staff from SiChuan Yongxing shale brick plant, and other 4 replication plants, SiChuan Xin Jin middlesized and small enterprises bureau
	Guangzhou field visit and local workshop	Ying de	Han Jun, Tao Rui, Zhang Zhixin.	Ying De Baojiang Cement material Co.LTD.
	Main finding summarizing and discussion	NCSTE	Chen Zhaoying, Han Jun, Tao Rui, Zhang Zhixin	
Oct. 2008	Main finding circulation among stakeholders	PMO	Wang Xiwu, Wang Gguiling, Han Jun, Chen Zhaoying, Tao Rui, Zhang Zhixin	
	Questionnaire withdrawal	NCSTE	Tao Rui, Zhang Zhixin	--
	Evaluation report Outline drafting and discussion	NCSTE	Han Jun, Taorui, Shi Xaoyong	--
Nov. 2008	Questionnaires analyzing	NCSTE	Hanv Jun, Tao Rui, Zhang Zhixin	--
	Final report drafting	NCSTE	Han Jun, Taor Rui, Shi Xiaoyong	--
Dec. 2008.	Draft Final Report discussion and revision	NCSTE	Chen Zhaoying, Han Jun, Tao Rui, Shi Xiaoyong, Yang Yun	--

Annex C. Questionnaire

Questionnaire for China Case Study of GEF Catalytic Role Evaluation

I. Contact Information

Name of Enterprises

Contact Person

Postal Address

Tel/Mobile

Fax

E-mail

Website

Note: The following questions are all single choice without specific notes. Please choose the best answer for each question with √. The information filled in this questionnaire should be about the case study project-Energy Conservation and GHG missions Reduction in Chinese TVEs.

II. Basic Information

1. Enterprise type

a. 8 GEF pilot enterprises b. 118 GEF replication enterprises

c. Independent replication enterprises

2. Sector

a. Coking b. Cement c. Brick Making d. Metal Casting

3. Establishment Date

_____yy _____mm _____dd

4. Size

a. Number of employees:

□ less than 50 □ between 50 and 100

□ between 100 and 200 □ more than 200

b. Registered capital:_____*(10 thousand Yuan)*

c. Gross output value in the year of 2007:_____*(10 thousand Yuan)*

d Total tax in the year of 2007:_____*(10 thousand Yuan)*

5. Technical modification phase

a. Technical Modification has been finished. The objective of energy conservation and GHG emissions reduction has been achieved.

b. Technical modification is being conducted.

c. Feasibility study has been done, but the technical modification has not been started yet.

d. Relevant study has been started, technical modification is under planning.

III. Catalytic Role Information

6. How do you know the information of TVE II project?

a. Government Advocacy b. Training

c. Workshop d. News report

e. Other (please specify)_____

_____

7. What is the most important reason of you to conduct technical modification?

a. Your own demand b. Response to government's call

c. Governmental mandatory measures

d. others (please specify)_____

_____

8. Fund sources

a. Global Environmental Facility (GEF) _____ *US dollar*

b. Counterpart funds/subsidies from central government_____ *Yuan*

c. Counterpart funds/subsidies from local government_____ *Yuan*

d. Bank loans from _____ *Yuan*

_____ bank,_____bank,_____bank

e. Self-financing _____ *Yuan*

f. Other sources (please specify) _____, _____ *Yuan*

9. Realized Energy conservation and emissions reduction (if technical modification is completed).

a. Energy conversation:_____tce/year [electricity saving:_____kwh/year]

b. Compared with feasibility study anticipation:

□ un-reached □ equivalent □ exceed [exceeding percentage:____%]

c. CO_2 emissions reduction:_____*tons / year,*

d. Compared with feasibility study anticipation:

□ un-reached □ equivalent □ exceed [exceeding percentage:____%]

e. □ Electrical energy Generated by Waste Heat :_____, □ Not applicable

Percentage of waste heat electrical energy in total utilized electrical energy:_____

%

f. Generated electrical energy compared with anticipation in feasibility study:

□ un-reached □ equivalent □ exceed [exceeding percentage:____%]

10. The expected annual energy conservation and emissions reduction capacity in the future:

a. Do you have annual plan on energy conservation and emissions reduction:

□ yes □ no

b. Expected energy conservation capacity:_____*tec/year*

c. Expected CO_2 emissions reduction capacity:_____*tons / year*

d. Expected electrical energy generated by waste heat:_____

e. Expected electrical energy saving:_____*kwh/year*

11. Whether the project execution accelerates policy issue and criteria formulation in local, sector and country level?

a. □ yes □ no

b. If yes, please specify:_____

_____

_____

12. Is there any management experience learned or formed during project implementation? Especially about energy efficiency management.

a. □ Formed by yourself

b. □ Learn from others

c. Main experiences of energy efficiency management: _____

_____

_____

13. Enterprises' development after project implementation:

a. Number of employees:

□ increase a lot □ increase □ unchanged □ decrease

b. Benefits:

□ increase a lot □ increase □ unchanged □ decrease

c. Market competition:

□ increase a lot □ increase □ unchanged □ decrease

14. After this project, your awareness on energy conservation and emissions reduction has been

□ increased a lot □ increase d □ unchanged

15. Is it difficult for new products/ technologies access to market?

a. □ yes □ no

b. If yes, what difficulties:_____

_____

c. Whether the difficulties influence the result of demonstration and dissemination:

□ serious □ a little □ non

d. Whether the problems are solved or not? □ yes □ no

e. How to solve it:_____

_____

16. How much fund is invested to the following technical modification activities after this project implementation? And what results did you get？(only filled by pilot enterprises)

a. Total_____***Yuan***

from Self-financing _____***Yuan***

External investment _____***Yuan***

Government subsidy _____***Yuan***

b. The following technical modification after this project is about:_____

_____

_____

c. The result of following activities:_____

_____

17. What technical modification activities have been conducted on the basis of experience learning? And what result did you get？

(filled by replication enterprises)

a. Total investment _____*Yuan*

from Self-financing _____*Yuan*

External investment _____*Yuan*

Government subsidy _____*Yuan*

b. The following technical modification activities after this project:_____

_____

_____

c. The result of following activities:_____

_____

18. Does any employee in your enterprise attend the relevant training of this project?

a. □ yes □ no

b. Trainings are about:_____

_____

c. Training times:_____; total number of trainees:_____

d. Whether the training knowledge is put into practice: □ yes □ no

19 Do you participate any demonstration activity or workshop about this project?

a. □ yes □ no

b. demonstration activity _____*times*

c. Technical workshops_____*times*

d. The activities or workshops are about:_____

_____

e. The effects of demonstration activities on project replication and dissemination:

□ very useful □ useful □ useless

f. The effects of workshops on project replication and dissemination:

□ very useful □ useful □ useless

20. Have you ever organized training about energy conservation technology?

a. □ yes □ no

b. If yes,_____*times,* _____ *trainees.*

c. Trainees are from: (multiple choice)

□ foreign countries □ other provinces

□ local province □ your enterprise

21. Do you offer any technical service to other enterprise about energy conservation?

a. □ yes □ no

b. If yes, what service do you offer:_____

_____

c. The number of enterprises receiving technical service:_____

22. Are there visitors going to your enterprise?

a. □ yes □ no

b. If yes, visit times:_____

total number of visitors:_____

c. Visitors are from: (multiple choice)

□ foreign countries □ other provinces □ local province

23. Do you have cooperation with foreign enterprise and institution, or arrange visit or training for them?

a. □ yes □ no

b. If yes, they are: (multiple choice)

□ Cooperation □ visit □ Training

c. Cooperating ways:_____

_____

d Contents of visit and training:_____

_____

e. Which country are these oversea enterprises or institutions from?_____

_____

24. As you know, is your experiences replicated by other enterprises by ways of visit, training or technical cooperation?

a. □ replicated □ Not-replicated

b. How many enterprises are benefited from replication?_____

c. Please give some examples:_____

_____

25. Do you think what the best way for project disseminating is?

(Single choice):

a. Visit b. Training c. Demonstration activity

d. Technical workshop e. Technical service

f. Other (please specify)_____

26. Are there any cooperation among enterprises, universities and research institutes about energy conservation? (multiple)

a. □ yes □ no

b. Cooperation ways: □ Joint R&D □Technical service □ Enterprise alliance □ Learning and communication □ Other (plea se specify)_____

_____

27. What do you think the contribution of LPIC, Industry Association, University and Research institute to project dissemination? What activities did they carry on?

a. Contribution of LPIC: □ a lot □ some □ no

Activities:_____

b. Contribution of Industry associations: □ a lot □ some □ no

Activities:_____

c. Contribution of Universities and Research institutes: □ a lot □ some □ no

Activities:_____

28. Have you signed the energy conservation Voluntary Agreement?

a. □ yes □ no

b. Promised energy conservation capacity

(tec, 10 thousand tons/year):_____

c. Promised emissions reduction capacity

(CO_2, 10 thousand tons/year):_____

d. The role of Voluntary Agreement on the project dissemination:

□ very useful □ useful □ useless

29. What actions did local government take to promote energy conservation and emission reduction? (multiple choice)

a. Fund support

b. Preferential policies

c. Mandatory measures

d. Propaganda

e. Nominating technical service supplier

f. Other (please specify) _____

30. What preferential policies did local government offer to enterprise for conducting energy conservation and emissions reduction project?

If has, please specify:

_____

_____

_____

31. What are the influencing factors of successful project dissemination?

(Please choose 3 important factors from the list below)

a. Fund support

b. Government advocacy

c. Preferential policies

d. Mandatory measures

e. Association promotion

f. Strengthening awareness

g. Inter-firm cooperation

h. Cooperation among Enterprise, University and Research institute

i. Other (please specify) _____

_____

_____

_____

Annex D. Field Visit/Workshop Checklist

This checklist combined main questions for pilot TVE, replication TVE, LPIC and other stakeholders in field visit or workshop.

1. Why did your enterprise decide to join in this project? How did you know the project information?
2. What about the results of energy conservation and emissions reduction in your enterprise? Whether the objectives have been reached? Do you have annual plan for energy conservation and emission reduction?
3. Do you plan to or already conduct any follow-up R&D activities about energy saving? What are they? What about the results? Whether these results were replicated and disseminated or not?
4. What changes did this project bring to your enterprise? (About enterprise size, number of employees, market share, investment and influence etc.)
5. How did the project implementation accelerate the policy issue or criteria formulation at local and country level?
6. Please describe the situation of visit, training and related dissemination activities.
7. Are there any cooperation between your enterprise and other enterprises in energy conservation and GHG reduction? Please offer the detail information.
8. By which ways did you finance for technical modification? Is it difficult?
9. How did local government promote energy conservation and emissions reduction during project period? What actions did they take? And what policies were issued?
10. What service did industry association / research institute offer to enterprises for their energy saving activity? Please give the information in detail.
11. Who is benefit from offering energy conservation services?
12. Do you think the awareness of energy conservation and emission reduction among entrepreneurs is improved by project implementation?
13. How do you think the tendency of project dissemination and replication in the future?
14. Please have a brief introduction on the relation between 8 pilot enterprises and 118 replication enterprises. How did the project support pilot enterprises and help the project replication and dissemination?
15. What roles do you think the GEF plays in the catalytic process?
16. Does Chinese TVE project have impact on the following environmental protection projects?
17. Please have an introduction on Revolving Capital Fund and its contribution to this project. Where did the fund come from? Whether all funds were distributed to enterprises by the way of loan?
18. Have you ever participated in disseminating activities? For example, training, onsite

demonstration and workshop etc. If yes, how do you think about its effect?

19. How do you think about the organizing and management model in this project? Do you think it's helpful to catalysis?
20. This project has attracted many independent replication enterprises (non-project fund), do you know about the current situation of these independent replication enterprises? And how do you know this information?
21. What factors do you think could influence the catalytic role? What experiences and lessons learned about the catalytic role play?

Annex E. Documents Reviewed/Reference

The study team reviewed the following documents:

- Final Independent Evaluation Report of 'Energy conservation and GHG emission reduction in Chinese township and village enterprises Phase II project', Frank Pool, Wen Gang. June, 2007.
- Mid-term Evaluation Report of 'Energy conservation and GHG emission reduction in Chinese township and village enterprises Phase II project', Frank Pool, Wen Gang. August, 2005.
- Presentations at International Forum on Energy Efficiency and GHG Reductions in SMEs (TVEs) & Cyclical Agriculture, 16-17 May, Hangzhou.
- Reference book of "Energy conservation and GHG emission reduction in Chinese township and village enterprises Phase II" project（Chinese）. Project management office, MOA, June, 2006.
- Case Study final report.
- Evaluation of the RCF Mechanism: Final report.
- Final Report For Pilot and Replication Project Energy Saving and GHG Emission Reduction Monitoring and Evaluation.
- Project Impact Evaluation: final report and sub-reports on PIC and LPIC mechanisms, policy impacts, market impacts and social impacts.
- Evaluation Report on mechanism and Feasibility of Energy Efficiency Voluntary Agreement, Final report.
- The Catalytic Role of International Aid: How is it measured and evaluated? GEF Evaluation Office, June 25, 2007.
- Catalytic Role of the GEF, A qualitative analysis of terminal evaluation for a sample of Biodiversity, Climate Change, and International Waters projects, Avery Ouellette, Sep. 3, 2007.
- Terms of Reference (TOR) for Country Case Study in catalytic role evaluation. GEF Evaluation Office, April 8, 2008.
- Related project documents provided by PMO, Chinese MOA.
- News from the internet.